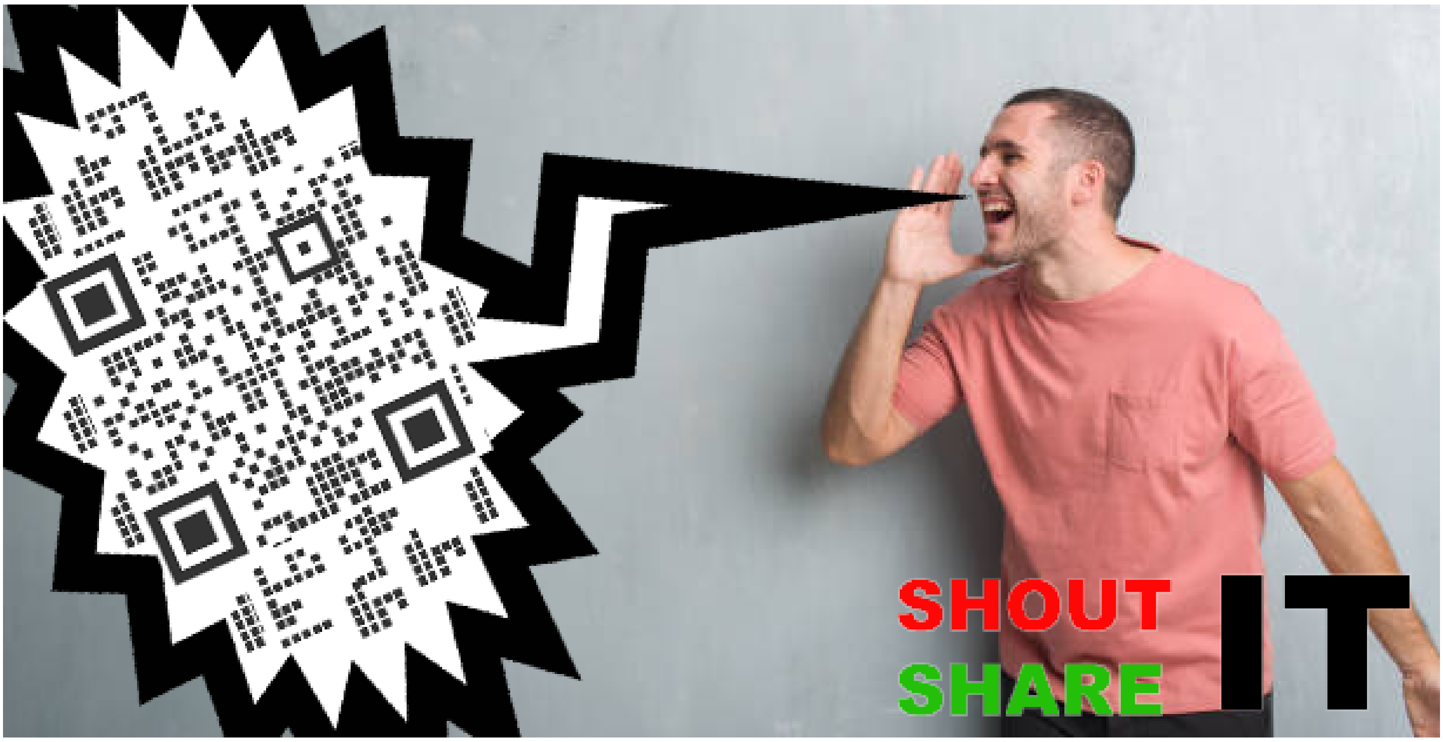

SHOUT
SHARE
IT

SBM
A
1015

BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY)

ENTOMOLOGY

VOL. II

1951–1952

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM (NATURAL HISTORY)
LONDON : 1952

DATES OF PUBLICATION OF THE PARTS

No. 1.	12 December 1952
No. 2.	21 December 1952
No. 3.	24 November 1952
No. 4.	6 February 1952
No. 5.	21 April 1952
No. 6.	18 December 1952

PRINTED IN
GREAT BRITAIN
AT THE
BARTHOLOMEW PRESS
DORKING
BY
ADLARD AND SON, LTD.

CONTENTS

ENTOMOLOGY VOLUME II

No. 1. The early literature on Mallophaga. Part II. 1763–75. By THERESA CLAY and G. H. E. HOPKINS (Pls. 1–3.) 1

No. 2. A revision of the Australian and Tasmanian Gripopterygidae and Nemouridae (Plecoptera). By D. E. KIMMINS 43

No. 3. Sphecidae and Pompilidae (Hymenoptera) collected by Mr. K. M. Guichard in West Africa and Ethiopia. By G. ARNOLD (Pls. 4–5.) 95

No. 4. A collection of Fleas from the bodies of British Birds. With notes on their distribution and host preferences. By MIRIAM ROTHSCHILD 185

No. 5. The Sub-Genus *Stegomyia* (Diptera: Culicidae) in the Ethiopian Region. Part I. A preliminary study of the distribution of species occurring in the West African Sub-Region with notes on taxonomy and bionomics. By P. F. MATTINGLY 233

No. 6. A review, and a revision in greater part, of the Cteniscini of the Old World (Hym., Ichneumonidae)./ By G. J. KERRICH 305

Index to Volume II [with 4 pls] 461

CORRIGENDA

Pp. 103. The legends to Figs. 5 and 5*a* (and to Pl. 4, fig. 1) to read *Cerceris longiuscula* instead of *Cerceris guichardi*.

P. 203. Below last entry under "Host" add: "*Larus argentatus* L. Herring Gull. B.M. — 1 —."

P. 225. Line 7 from bottom should read "an atypical female, probably of *C. borealis*, and one male of *C. garei* (Rothschild, 1948), *etc.*"

A.
O.
17 DEC 1951

THE EARLY LITERATURE ON MALLOPHAGA

(PART II)

THERESA CLAY
AND
G. H. E. HOPKINS

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 2 No. 1
LONDON : 1951

THE EARLY LITERATURE ON MALLOPHAGA

BY

THERESA CLAY

AND

G. H. E. HOPKINS } xrefs.

PART II. 1763–1775

Pp. 1–36; *Pls.* 1–3; 45 *Text-figures*

BRITISH MUSEUM NATURAL HISTORY

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 2 No. 1
LONDON : 1951

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in 1949, is issued in five series, corresponding to the Departments of the Museum.*

Parts appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, No. 1 of the Entomology series.

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued November 1951 *Price Ten Shillings.*

THE EARLY LITERATURE ON MALLOPHAGA

By THERESA CLAY *and* G. H. E. HOPKINS

PART II, 1763–1775

SYNOPSIS

This is the second part of a series of papers in which it is intended to review the species of Mallophaga described between 1758 and 1818. This part deals with the twenty species described by G. A. Scopoli in 1763 and 1772, the single species described by Pontoppidan in 1763, and the three species described by J. C. Fabricius in 1775.

In the first part of this work (Clay and Hopkins, 1950) we remarked on the possibility that specimens in the Nitzsch collection that are not the types of names given by Nitzsch might wrongly be considered as types by writers who do not accept the rules of nomenclature. We were not aware, when we wrote this, that Kéler (1941) had listed many of the Halle specimens of species described by Nitzsch in 1818 by reference to older descriptions as the types of the 1818 names. Leaving aside queried instances, the names affected that concern us in our discussion of the early literature are as follows:

Trichodectes crassus Nitzsch (p. 129). The specimens of *Pediculus melis* in Fabricius's collection are still preserved at Copenhagen and are of necessity the types of *crassus* as well as of *melis*.

Trichodectes scalaris Nitzsch (p. 130). Since *scalaris* is merely a *nomen novum* for *Pediculus bovis* Linn., the types are the lost specimens of Linné, which we have replaced (1950: 227). The specimens in Nitzsch's collection have no special status.

Trichodectes longicornis (p. 130). Although the specimens in the Nitzsch collection at Halle are not types, there is no reason why one of them should not be erected as a neotype, and we intend to take this course in the final instalment of this work. Until this is done they have no special status.

No host-records are given in Kéler's list mentioned above, but the hosts can be ascertained by reference to his two papers 'Baustoffe zu einer Monographie der Mallophagen', Parts I and II (1938 and 1939), and (as it happens) in none of the above-mentioned cases is the host of Nitzsch's material definitely different from that of the earlier author on whose description or figure Nitzsch's 1818 names rest their sole claim to validity. We therefore considered whether we could accept Kéler's listing of these specimens as types of Nitzsch's names as constituting them neotypes of the earlier names, but we have decided against this. In the instances mentioned above (except in the case of *crassus*) this course might be possible, but in the case of *crassus* the original types are still in existence at Copenhagen and in other cases, also, it would be quite impossible to accept Kéler's listing. As an instance, *Goniodes dissimilis* was first described by Denny in 1842 and the specimens listed by Kéler (p. 133) would (if they have any status at all) be types of *Goniodes dissimilis* Nitzsch 1874 (not *G. dissimilis* Denny 1842, nor *G. dissimilis* Gurlt 1842) if the species were not the same. We think the principle underlying these statements of fact to be of such importance that we find ourselves unable to stretch a point by regarding Kéler's listing of specimens as 'Typen' of Nitzsch's 1818 names as constituting them neotypes of the older names on which Nitzsch based them in 1818. We are confirmed in this attitude by the fact that Kéler has evidently not studied the early literature at all—'*equi* (Lin.)', for instance, does not exist, no species having been described under this name prior to 1842, when Denny described it.

We are indebted to the Trustees of the British Museum for permission to publish Figs. 9, 10, 21, 31, 32, 34, drawn by Mr. A. J. E. Terzi, and to Colonel Meinertzhagen for permission to publish Figs. 8, 16–18, 23–25, 29–30, 38–40 drawn by Mr. R. S. Pitcher. Figs. 2, 11, 12, 15, 20, 33, 36 were drawn by Miss B. A. Read. The remaining figures were drawn by Miss T. Clay. We are also indebted to Captain W. H. Pollen for the photographs on Pl. II, figs. 1–2; the other photographs, with the exception of Pl. I, fig. 2, were taken by Mr. H. M. Malies.

In the measurements given under each species the length of the male genitalia has almost always been taken from a specimen other than the neotype: it has, therefore, not been considered necessary to note this fact in individual instances, as we did in Part I of this work.

SCOPOLI 1763 (*Entomologia Carniolica.* Vindobonae: 381–385)

The names in this work are unquestionably in valid form, and the descriptions, though very brief, are usually adequate for the recognition of the genus, which is as much as we can expect from the old descriptions. Scopoli's collections are stated to have been destroyed, either by fire or shipwreck, in 1776.[1]

Pediculus haematopus (p. 381)

The description is undoubtedly that of a *Philopterus s.l.* and the host-record is '*Habitat in Falcone Palumbrio, & Strige Ulula*'. The name would, therefore, refer to a mixture of a *Craspedorrhynchus* and a *Strigiphilus* but for the fact that Scopoli notes that the specimens from the owl were slightly different, thus constituting *Falco palumbarius* = *Accipiter gentilis* (Linn.) the type-host. J. C. Fabricius (1775: 806) unnecessarily renamed the species *Pediculus Strigis* (*nec P. strigis* Pontoppidan, 1763), and Nitzsch (1818: 290) again renamed it *Philopterus* (*Docophorus*) *platyrhynchus*. Harrison's erroneous belief that *haematopus* is preoccupied by *haematopi* Linn., 1758 (which is not a homonym), has caused most later authors to call the species by the name given to it by Nitzsch.

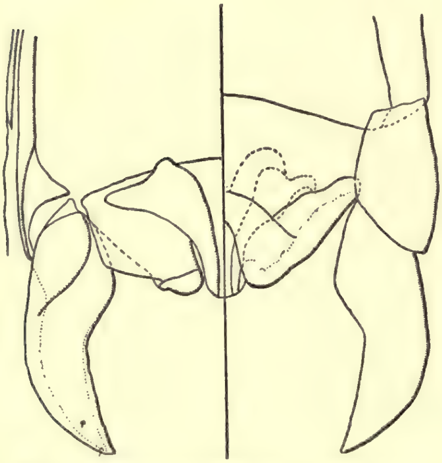


FIG. 1. *Craspedorrhynchus haematopus* (Scopoli), male genitalia. ×351.

Pediculus tinnunculi Latreille? 1818 (*nec* Linné 1758) is also a synonym of *Craspedorrhynchus haematopus* (Scopoli). As pointed out by Hopkins (1949, *Ann. Mag. nat. Hist.* (12) **2:** 48), it is based on a drawing copied from one copied by Hooke (in Albin's *Natural History of Spiders and Other Curious Insects*, 1736) from one of Redi's figures of 'Pollini dell' Astore', so the host is *Accipiter gentilis* (Linn.).

---

[1] Horn, W., and Kahle, J., 1936. Über entomologische Sammlungen. *Ent. Beiheften* **3**: 252.

Neotype male (Fig. 1) and neallotype female (Fig. 2) of *Craspedorrhynchus haematopus* (Scopoli) from *Accipiter g. gentilis* (Linn.) from Estonia (Meinertzhagen collection slide No. 1464); these specimens agree in characters other than those figured here with the figures published by Merisuo (1945, pl. 2, fig. D; pl. 3, figs. D, d). *Neoparatypes:* 14 males and 12 females from the same host-form, Estonia.

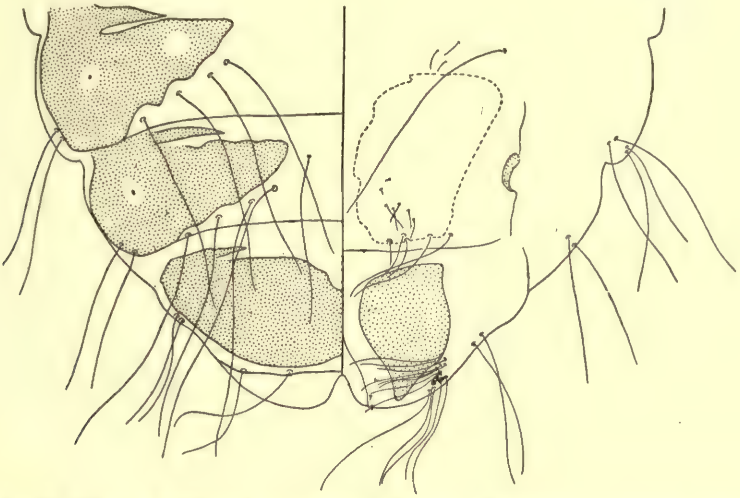


FIG. 2. *Craspedorrhynchus haematopus* (Scopoli), terminal segments of female abdomen. × 102.

The neotypes are automatically also neotypes of *Craspedorrhynchus strigis* (J. C. Fabricius) 1775 and of *Craspedorrhynchus platyrhynchus* (Nitzsch) 1818.

Pediculus maximus (p. 382)

The particulars given, especially the size, can apply only to a *Laemobothrion*, and this fact has been recognized ever since the genus was erected. The host is *Falco Buteo* = *Buteo buteo* (Linn.).

J. C. Fabricius (1776: 309) renamed the species *Pediculus Buteonis*; Nitzsch (1818: 301) proposed the name *Liotheum* (*Laemobothrion*) *giganteum* for *maximus* Scopoli, *buteonis* Fabricius, and *circi* Geoffroy, and we shall deal with Nitzsch's name in such a way as to make it a synonym of *Laemobothrion maximum* (Scopoli).

Eichler has figured the species (1941, fig. 28, and 1942, fig. 4) and in the second of these papers he erects (p. 59) a neotype for the species, the neotype being from a specimen of *Buteo vulgaris* collected at Agna Manja, Teneriffe; Dr. Eichler informs us (*in litt.*) that this was probably *Buteo buteo insularum* Flöricke.

Eichler's neotype of *Laemobothrion maximum* (Scopoli) is automatically also neotype of *L. buteonis* (J. C. Fabricius), but not of *L. giganteum* (Nitzsch).

Pediculus coarctatus (p. 382)

The host-record is *'Lanio Collur'*. Harrison (1916: 12) considered the name to apply to a *Menopon s.l.* and placed *M. fuscocinctum* Denny and other names in the synonymy, but this identification of Scopoli's species is quite certainly incorrect, for the mention of a white abdomen with seven conical fuscous spots on each side and with a fuscous apical fascia, coupled with the host-record, is completely diagnostic of a *Philopterus*. J. C. Fabricius (1798: 570) described a *Pediculus lanii*, from *Lanius collurio* Linn., which we consider to be the same species, and Schrank (1803: 187) described a *Pediculus collurionis* from 'Dorndreher' (= *L. collurio*). Schrank's description is independent, but he quotes *coarctatus* as a synonym and his species is certainly a *Philopterus*; we identify this, also, as a synonym of *coarctatus*.

The species of *Philopterus* parasitizing the small European Passeres are very similar to each other, and in many cases it is difficult (if not impossible) to distinguish the females of two species. Specific differences in the head may be found in the form of the hyaline margin and the shape of the dorsal anterior plate (clypeal signature). The measurements of the head are, in general, unreliable characters; not only is there considerable variation within a species but, although species may be distinguished from each other by the means of the length or breadth, there is always considerable overlap, making the identification of many specimens by measurements impossible. Again, in most species the proportions of the head show no reliable specific differences; the cephalic index (breadth : length) tends to remain constant and gives less indication of differences than do the actual measurements of length and breadth. Tables of the C.I. and breadth measurements for three species illustrate these points (Tables 1–4).

As in most species with heavily sclerotized plates, there is always considerable variation in the outline of these plates. The exact outline of the prosternal plate, the abdominal tergites, and the sternites of the male and female genital regions cannot, therefore, be used as specific characters. The prosternal plate may vary considerably in outline within one species (Fig. 3), but in some species (*P. citrinellae* (Schrank), for instance) the posterior part is more heavily sclerotized and pigmented. The female genital plate varies in outline (Fig. 44 shows the outline in four specimens of *P. fringillae* taken from the same host individual), but such characters as the curvature of the anterior margin and the ratio of breadth to length may be of specific importance. Comparison of the female genital plate of *P. coarctatus* with that of *P. fringillae* shows that the anterior margin always tends to be more rounded in the former than in the latter. The ratio of breadth to length is given in Table 5; the variation is caused by the variation in the length of the plate due to the lack of posterior sclerotization in some specimens, the breadth tends to be fairly constant.

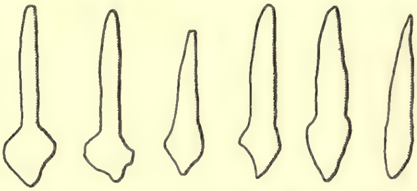


FIG. 3. *Philopterus coarctatus* (Scopoli), prosternal plates of 6 females taken from one host individual. × 175.

The chaetotaxy of the thorax and abdomen shows much variation, but some

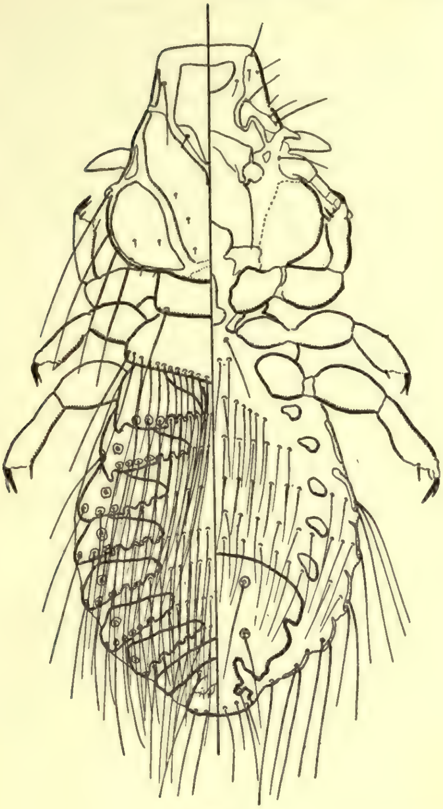


FIG. 4

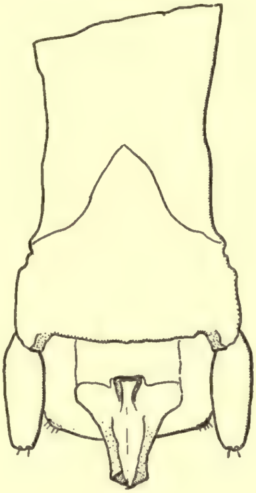


FIG. 5

FIGS. 4–5. *Philopterus coarctatus* (Scopoli): 4. Male (setae not shown on legs). 5. Male genitalia. × 196.

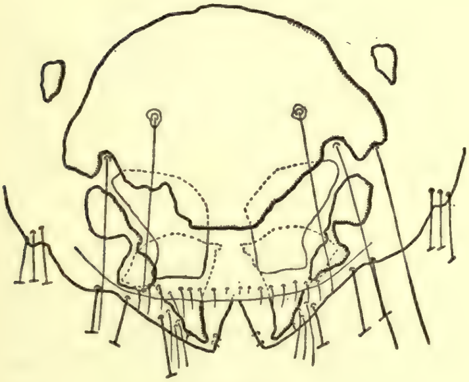


FIG. 6

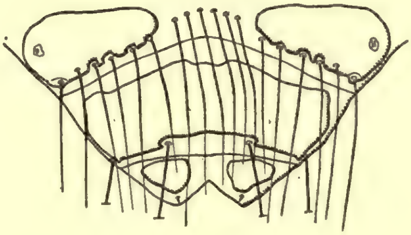


FIG. 7

FIGS. 6–7. *Philopterus coarctatus* (Scopoli), terminal segments of female abdomen: 6. Ventral view. × 152. 7. Dorsal view. × 107.

species can be distinguished by the unusually large or small number of setae on certain segments.

The male genitalia, as is usual throughout the Ischnocera, give the most reliable specific differences, although in these characters, also, the differences are of small magnitude.

Philopterus coarctatus (Scopoli) (Figs. 3–7; Pl. I, fig. 1; Tables 1–5) is distinguished in the male by the characters of the genitalia, and in the female by the form of the hyaline margin, the prosternal plate, and the proportions of the genital plate.

Measurements in mm.

	Male		*Female*	
	Length	*Breadth*	*Length*	*Breadth*
Head . . .	0·55	0·50	0·60	0·57
Prothorax. . .	..	0·28	..	0·32
Pterothorax . .	..	0·42	..	0·48
Abdomen . . .	0·78	0·62	1·02	0·80
Total . . .	1·55	..	1·67	..
Genitalia . . .	0·27	..	..	..

Neotype male (Figs. 4–5) and *neallotype* female (Figs. 3, 6, 7; Pl. I, fig. 1) of *Philopterus coarctatus* (Scopoli) from *Lanius c. collurio* Linn., from Yugoslavia (British Museum (Natural History) collection, slide No. 485). *Neoparatypes*: 28 males and 51 females from the same host-form from Yugoslavia, Poland, Estonia, Sweden, the British Isles, and the Anglo-Egyptian Sudan.

Pediculus ocellatus (p. 382)

The unusually good description places it beyond doubt that this species is a *Philopterus*, as has long been accepted. The hosts, however, are *Corvus corax* and *C. cornix*, so that the name originally applied to a mixture of *Philopterus corvi* (Linn.) and a second species which had not then been described. It has commonly been accepted as a principle that the first host mentioned by an author should be regarded as the type-host, but we can only accept this principle when there is no strong reason in favour of its rejection. In the present instance the fact that *ocellatus* has been accepted since 1818 (at least) as referring to the species found on *Corvus corone cornix* would be a very strong argument against accepting *Corvus corax* as type-host even if Nitzsch (1818: 290) had not restricted *ocellatus* to the species found on *C. corone* and its sub-species.

J. C. Fabricius (1775: 807) unnecessarily renamed the species as *Pediculus Cornicis* and dropped the mention of *Corvus corax* as a host. Nitzsch (1818: 290) retained Scopoli's name, contrary to his usual practice, and the species was subsequently always known as *ocellatus* (the authorship usually wrongly ascribed to Nitzsch) until Thompson (1935: 214) mistakenly replaced this name by *Philopterus corvi* (Linn.), with which we have already dealt and which is not the same species.

Philopterus ocellatus (Scopoli) is distinguished from *P. corvi* (Linn.) by having the anterior plate (= clypeal signature) heavily sclerotized and pigmented posteriorly, and by the characters of the male genitalia and female genital region.

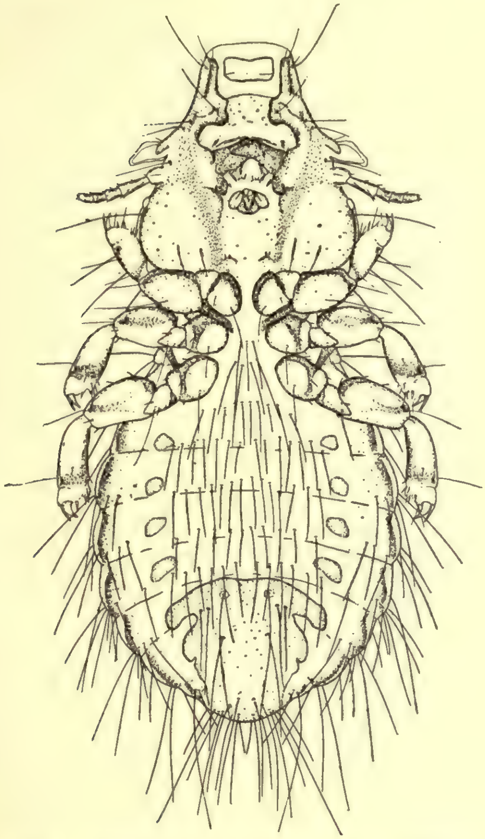


FIG. 8. *Philopterus ocellatus* (Scopoli), male.

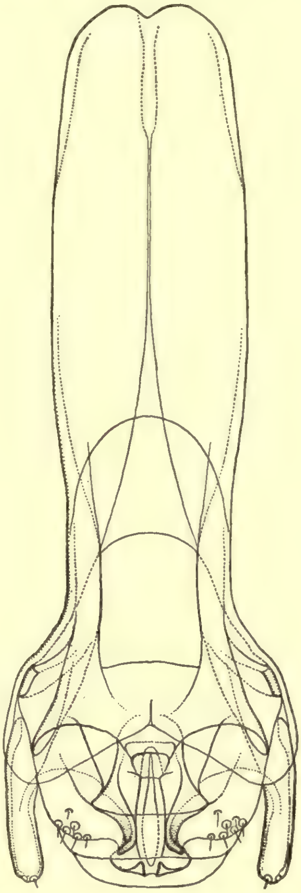


FIG. 9. *Philopterus ocellatus* (Scopoli), male genitalia.

Measurements in mm.

	Male		*Female*	
	Length	*Breadth*	*Length*	*Breadth*
Head . . .	0·75	0·76	0·80	0·80
Prothorax. . .	..	0·47	..	0·48
Pterothorax . .	..	0·68	..	0·70
Abdomen . . .	1·34	1·11	1·36	1·12
Total . . .	2·46	..	2·50	..
Genitalia . . .	0·48	..	..	..

Neotype male (Figs. 8–9, 11; Pl. I, fig. 2) and *neallotype* female (Figs. 10, 12) of *Philopterus ocellatus* (Scopoli) from *Corvus corone sardonius* Kleinschmidt from

Yugoslavia (British Museum (Natural History) collection, slide No. 484). *Neoparatypes*: 10 males and 9 females from the same host-form from Yugoslavia, Greece, Palestine, and Egypt and 40 males and 30 females from *Corvus corone cornix* Linn. from the British Isles, Estonia, and Sweden.

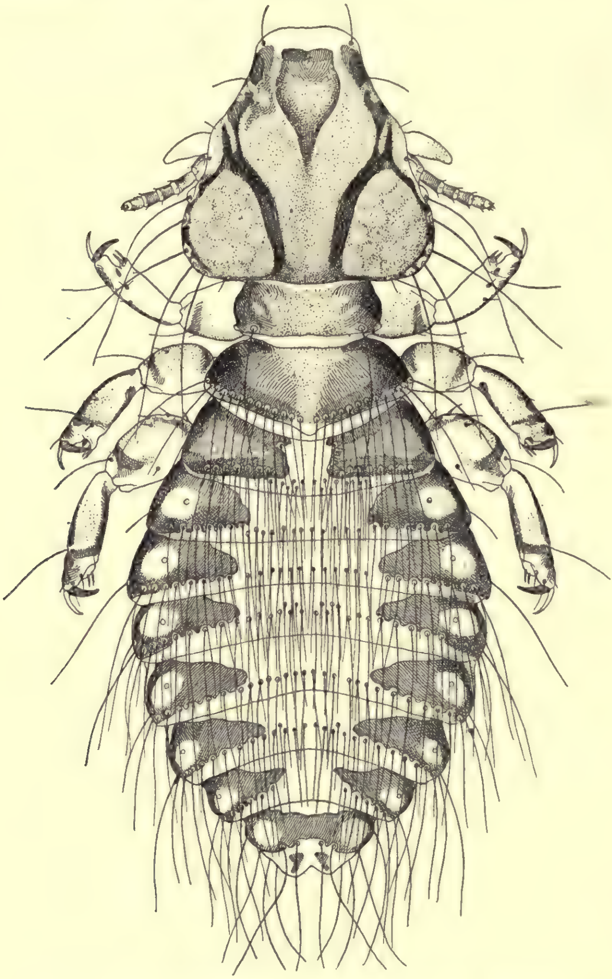


FIG. 10. *Philopterus ocellatus* (Scopoli), female.

These neotypes are also neotypes of *Philopterus cornicis* (J. C. Fabricius). There is no such species as *Philopterus ocellatus* (Nitzsch).

Pediculus dolichocephalus (p. 382)

There has never been any doubt about the identity of this species, the very brief description agreeing with no oriole-parasite except *Ricinus*. The original host-record is '*Habitat in Coracia Oriolo*', which Harrison (1916: 66) misconstrued as meaning *Coracias* and *Oriolus*, evidently not realizing that in Scopoli's time the oriole was contained in the genus *Coracias*. Similar errors will be mentioned under *Pediculus ardealis* and *P. troglodytis*.

J. C. Fabricius (1776: 310) renamed the species *Pediculus Orioli*, and Nitzsch (1818: 302) called it *Liotheum* (*Physostomum*) *sulphureum*, but there is not the slightest justification for either of these *nomina nova*. The description given by Fabricius is an abridged version of that of Scopoli, and Nitzsch gives no description and no 'indication' except a reference to Scopoli, so both these names derive their validity solely from Scopoli's description.

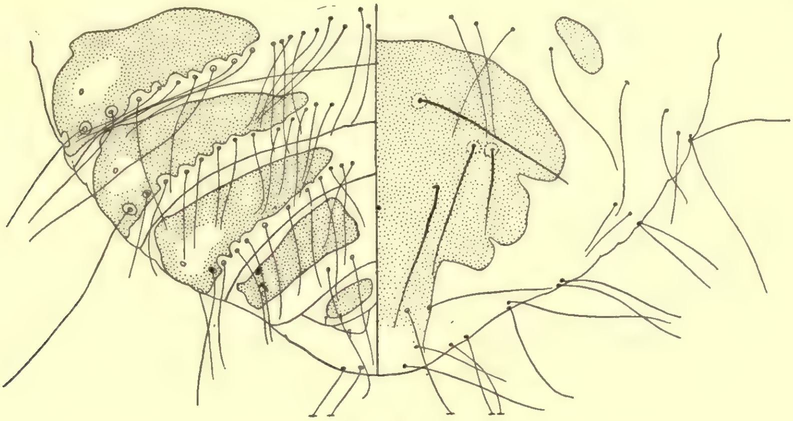


FIG. 11

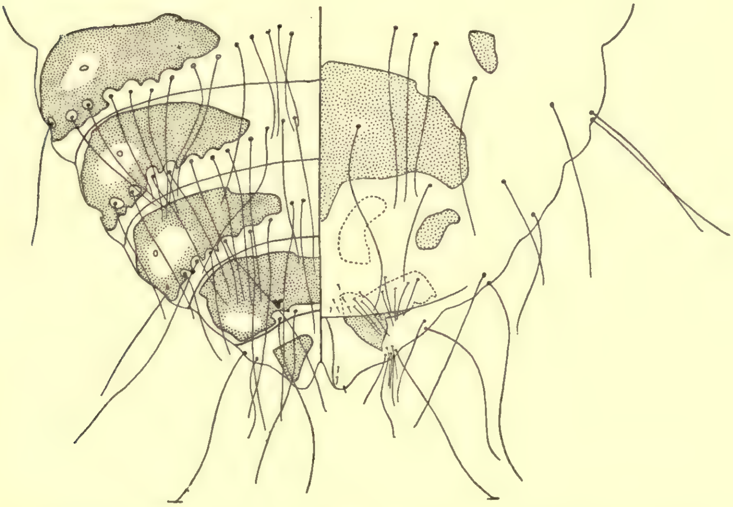


FIG. 12

FIGS. 11–12. *Philopterus ocellatus* (Scopoli), terminal segments of abdomen: 11. Male. ×89. 12. Female. ×67.

This species is distinguished from other species of *Ricinus* by the characters of the mandibles (Fig. 13),[1] by the shape of the head and the characteristic colour-pattern of the body (Pl. I, fig. 3), the characters of the male genitalia (Fig. 14), and the terminal segments of the female abdomen (Fig. 15).

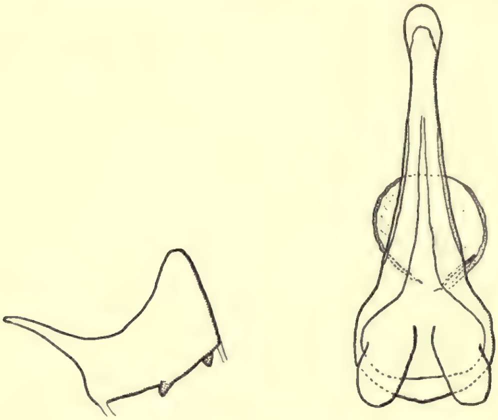


FIG. 13 FIG. 14

FIGS. 13–14. *Ricinus dolichocephalus* (Scopoli): 13. Left mandible. × 191. 14. Male genitalia.

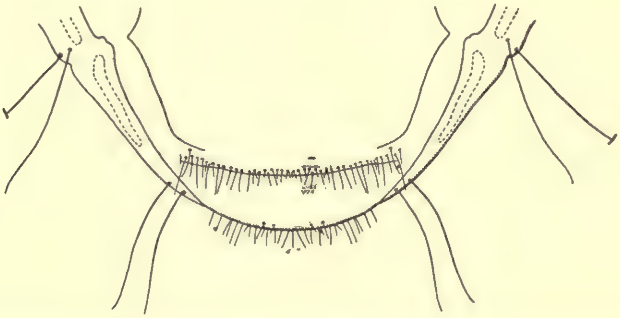


FIG. 15. *Ricinus dolichocephalus* (Scopoli), terminal segments of female abdomen, ventral. ×75.

Measurements in mm.

	Male		*Female*	
	Length	*Breadth*	*Length*	*Breadth*
Head . . .	0·76	0·68	0·97	0·78
Prothorax . . .	..	0·57	..	0·70
Pterothorax . .	..	0·75	..	1·03
Abdomen . . .	..	0·83	..	1·16
Total . . .	3·50	..	4·65	..
Genitalia . . .	0·46	..	..	..

Neotype male (Figs. 13–14) and *neallotype* female (Fig. 15; Pl. I, fig. 3) of *Ricinus dolichocephalus* (Scopoli) from *Oriolus o. oriolus* (Linn.) from NE. Poland (Meinertzhagen collection, slide No. 4190). *Neoparatypes*: 3 males and 10 females from same host-form, NE. Poland, Switzerland, and Cyprus.

---

[1] These structures show characters of specific value throughout the genus *Ricinus*.

These neotypes are, of necessity, also neotypes of *Ricinus orioli* (J. C. Fabricius) and of *R. sulphureus* (Nitzsch).

Pediculus fasciatus (p. 383)

The host is *Cuculus canorus* and the description, unmistakably that of the characteristic *Cuculiphilus* found on this bird, has long caused the name to be correctly ascribed to this louse.

J. C. Fabricius (1775: 807) renamed the species *Pediculus Cuculi*, his description being copied from that of Scopoli, and Nitzsch (1818: 300) proposed *Liotheum* (*Menopon*) *phanerostigmaton* as a *nomen novum* for it. The species went under this latter name (and its variant, *phanerostigma* Giebel) until Harrison (1916: 47) restored Scopoli's name. Uchida (1926: 47) designated *Pediculus fasciatus* Scopoli as type species of *Cuculiphilus*.

Neotype male (Figs. 16–17) and *neallotype* female (Fig. 18) of *Cuculiphilus fasciatus* (Scopoli) from *Cuculus c. canorus* Linn. from NE. Poland (Meinertzhagen collection, slide No. 4211). *Neoparatypes*: 3 males and 8 females from same host-form, NE. Poland, Ushant (France), and Tanganyika Territory.

These neotypes are automatically also neotypes of *Cuculiphilus cuculi* (J. C. Fabricius) and of *C. phanerostigmaton* (Nitzsch).

Neotype of *Cuculiphilus phanerostigma* (Giebel), a male from *Cuculus c. canorus* Linn. from Ushant, France (Meinertzhagen collection, slide No. 780), agreeing with the neotype of *Cuculiphilus fasciatus* (Scopoli).

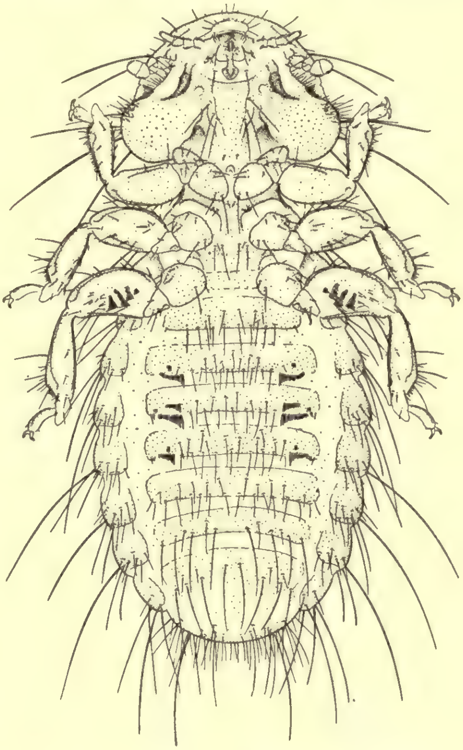


FIG. 16. *Cuculiphilus fasciatus* (Scopoli), male.

Measurements in mm.

	Male		Female	
	Length	*Breadth*	*Length*	*Breadth*
Head	0·35	0·58	0·35	0·63
Prothorax	..	0·37	..	0·39
Pterothorax	..	0·45	..	0·48
Abdomen	0·90	0·73	1·02	0·82
Total	1·52	..	1·79	..
Genitalia	0·48	..	..	..

Pediculus auritus (p. 383)

The hosts are *Picus major* and *P. martius*, i.e. *Dryobates major* (Linn.) and *Dryocopus martius* (Linn.), and the description unquestionably refers to a *Penenirmus*. In the absence of any indication to the contrary, we regard the first host mentioned by Scopoli as the type-host. Schrank (1803: 188) described a *Pediculus Pici* from 'Schwarzpecht' (= *Dryocopus martius*), placing *auritus* Scopoli as a synonym, but we cannot accept this as a restriction of *auritus* to one host, especially as Schrank also placed *Pulex picae* Redi (i.e. *Myrsidea picae* (Linn.), from *Pica pica*) as a synonym.

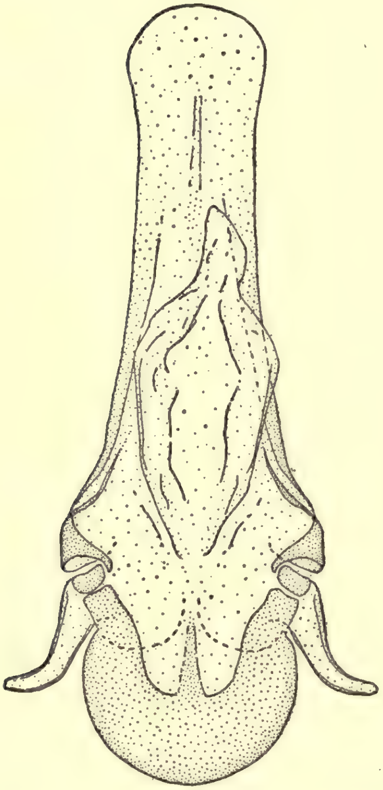


FIG. 17. *Cuculiphilus fasciatus* (Scopoli), male genitalia.

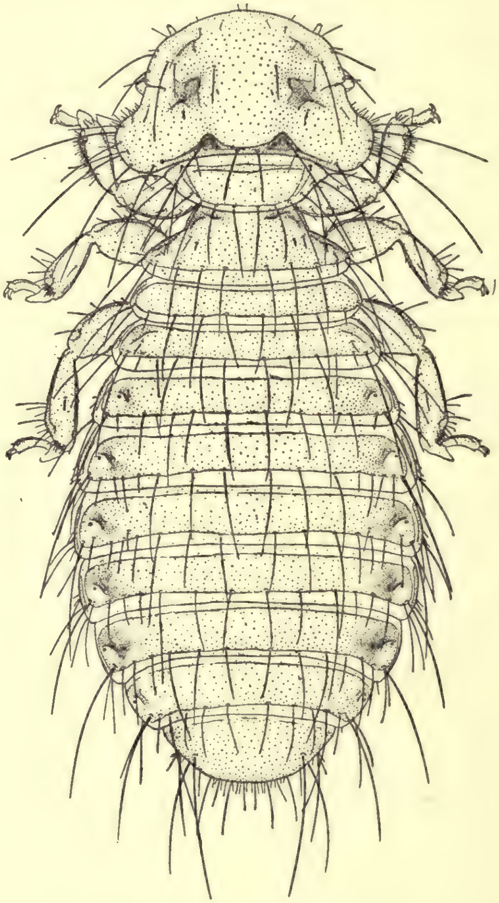


FIG. 18. *Cuculiphilus fasciatus* (Scopoli), female.

Burmeister (1838: 427) and Giebel (1874: 94, pl. 10, fig. 3) described as *Docophorus superciliosus* an insect that seems to be certainly the same as *Penenirmus auritus* (Scopoli) and is from *Dryobates major* (Linn.). Harrison (1916: 88) listed *auritus* in *Philopterus* with *superciliosus* as a synonym.

Neotype male (Fig. 19; Pl. I, fig. 4) and neallotype female (Fig. 20) of *Penenirmus auritus* (Scopoli) from *Dryobates major pinetorum* (Brehm) from Yugoslavia (British Museum (Natural History) collection, slide No. 498). *Neoparatypes*: 12 males and 21 females from same host-form, Jugoslavia and NE. Poland; 23 males and 26 females from *Dryobates major major* (Linn.), Estonia.

Measurements in mm.

	Male		*Female*	
	Length	*Breadth*	*Length*	*Breadth*
Head . . .	0·53	0·48	0·57	0·50
Prothorax. . .	..	0·29	..	0·30
Pterothorax . .	0·40	0·46	0·43	0·51
Abdomen . . .	0·93	0·60	1·12	0·65
Total . . .	1·72	..	1·99	..
Genitalia . . .	0·28	..	..	..

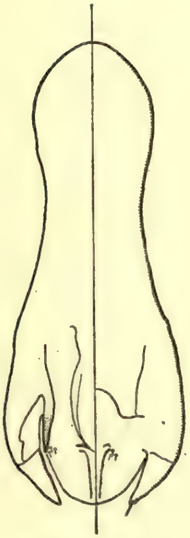


Fig. 19

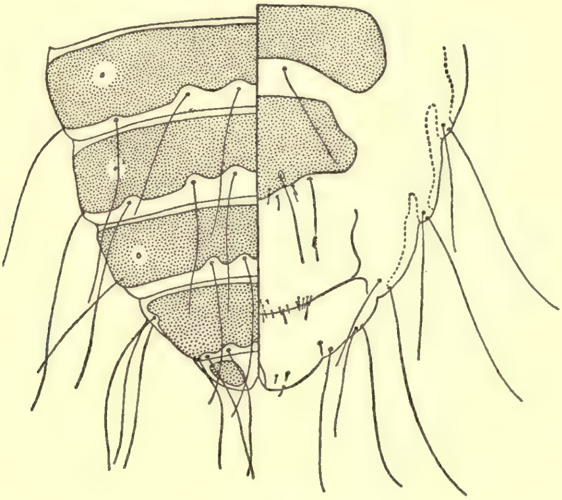


Fig. 20

Figs. 19–20. *Penenirmus auritus* (Scopoli): 19. Male genitalia. 20. Terminal segments of female abdomen. ×87.

Neotype of *Penenirmus superciliosus* (Burmeister) a male from *Dryobates m. major* (Linn.), Estonia (Meinertzhagen collection, slide No. 1568), agreeing with our description and figures of the neotype of *Penenirmus auritus* (Scopoli).

Pediculus dentatus (p. 383)

The host-record is merely '*in Anate*', but as the next species described by Scopoli is from *Anas boschas*, now known as *A. platyrhynchos* Linn., we think it only reasonable to assume that *dentatus* was from the same host, the specific name of which was inadvertently omitted. The description is definitely that of an *Anatoecus*. Eichler

(1946: 75) selected *Anas platyrhynchos* as type-host of this species, but without erecting neotypes.

We can find nothing in the subsequent literature that adds anything to our knowledge of this species; Harrison (1916: 13, 93) referred it to *Philopterus*, placing most of the duck-infesting species as synonyms, but pending redescription of the numerous species that have been described from ducks we are unable to suggest which names are synonyms of *Anatoecus dentatus* (Scopoli).

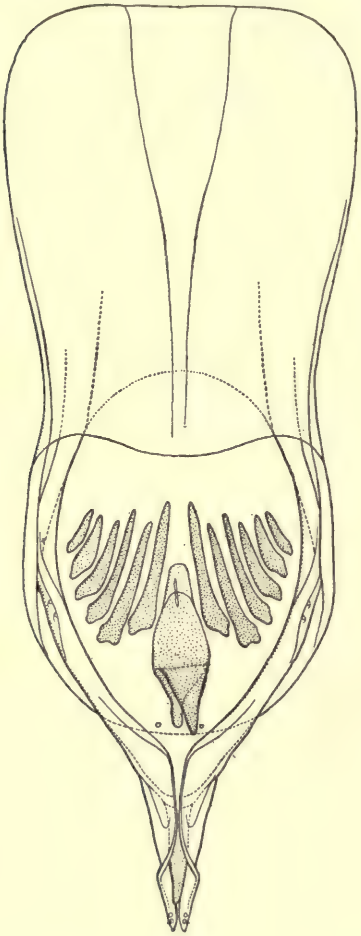


FIG. 21

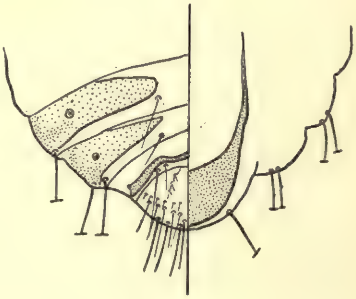


FIG. 22

FIGS. 21–22. *Anatoecus dentatus* (Scopoli), male. 21. Genitalia. 22. Terminal segments of abdomen. × 97.

Cummings (1916: 652) was the first author to draw attention to the two distinct forms of genitalia found in male *Anatoecus*—those with and those without the so-called 'effractor'. Unfortunately his otherwise excellent account of various species found on the Anatidae is rendered largely useless by his failure to give any indication of the host of the majority of the species that he figured. Cummings did not discuss the distribution of the two groups of species, but it has been found that on all the European ducks from which material is available there are two species of *Anatoecus*, the males of which are separable by the presence or absence of the effractor in addition to other less obvious characters. It has not been possible to assign the females to the different males with certainty, and for this reason no female neallotype nor neoparatypes will be designated for *dentatus* or other species of *Anatoecus* with which we shall deal. Cummings made *Philopterus icterodes* Nitzsch the type-species of *Anatoecus* and placed it in the group without an effractor; this species will be dealt with later and Cummings's interpretation will be followed. Cummings did not mention *dentatus* Scopoli, and in order to fix representative species of the two main groups by the erection of neotypes and publication of figures we have chosen the species from *Anas platyrhynchos* in which the effractor is present to bear the name *dentatus* Scopoli.

Measurements in mm.

	Male	
	Length	*Breadth*
Head	0·47	0·43
Prothorax	..	0·28
Pterothorax	..	0·37
Abdomen	0·72	0·60
Total	1·45	..
Genitalia	0·46	..

Measurements in mm. of heads of specimens examined

Individual No.	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*
Total length in midline	0·47	0·50	0·47	0·48	0·45	0·45	0·50	0·46	0·47	0·48
Length of hyaline margin	0·16	0·17	0·16	0·16	0·15	0·15	0·17	0·16	0·15	0·15
Breadth at temples	0·43	0·43	0·42	0·43	0·42	0·42	0·43	0·41	0·42	0·43
Breadth at base of hyaline margin	0·25	0·26	0·25	0·25	0·25	0·26	0·27	0·24	0·26	0·25

Neotype male (Figs. 21–22; Pl. I, fig. 5) of *Anatoecus dentatus* (Scopoli) from *Anas p. platyrhynchos* Linn. from NE. Poland (Meinertzhagen collection, slide No. 4176). *Neoparatypes*: 9 males from same host-form, Poland and England.

Pediculus crassicornis (p. 383)

The host is *Anas Boschas* and the louse is undoubtedly an *Anaticola*.

Schrank (1781: 503) described as *Pediculus Anatis* a form which is certainly partly *crassicornis* and which will be discussed later; his host is '*Anas Boschas*, varietas fera', but there is some evidence of confusion with *Anaticola anseris* (Linn.). J. C. Fabricius (1798: 571) also described a *Pediculus Anatis* from *Anas Boschas*, his description being apparently independent. *Nirmus crassicornis* 'Olfers' (see Harrison, 1916: 13) does not exist, von Olfers correctly attributing the name to Scopoli, though his host-records indicate the confusion between this species and *anseris* for which Schrank appears to be responsible. Nitzsch (1818: 292) proposed *Philopterus* (*Lipeurus*) *squalidus* as a *nomen novum* for *Pediculus anatis* Fabricius; this name, also, is a synonym of *Anaticola crassicornis* (Scopoli).

This species is distinguished from *Anaticola anseris* (Linn.) (see Clay and Hopkins, 1950: 239) by the characters of the anterior region of the head and the shorter penis (see measurements).

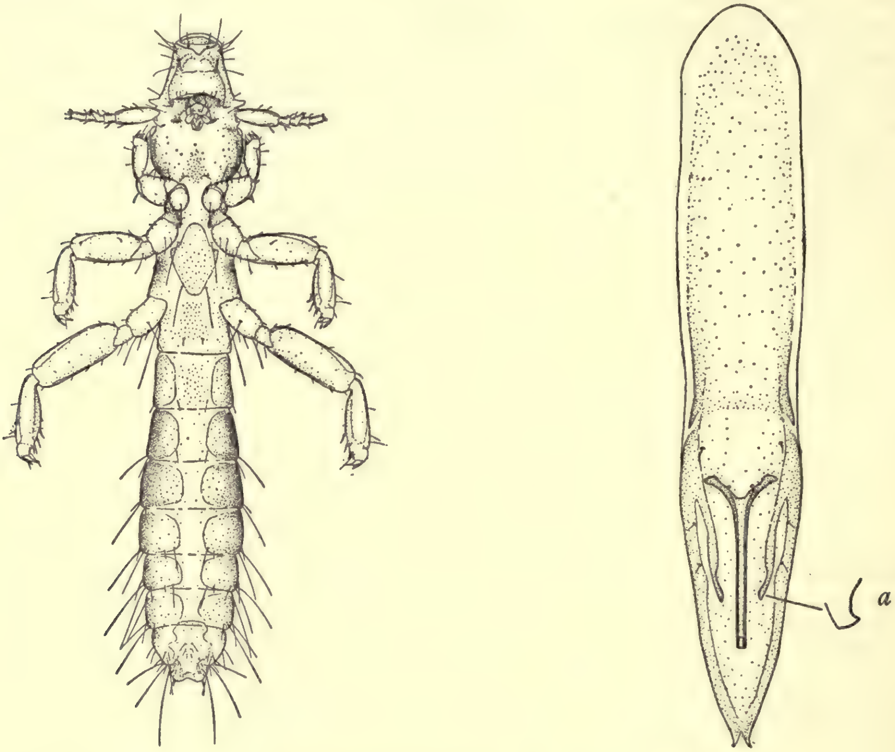


FIG. 23 FIG. 24

FIGS. 23–24. *Anaticola crassicornis* (Scopoli): 23. Male. 24. Male genitalia. ×144; *a*. Tip of paramere from side. ×437.

Measurements in mm.

	Male		*Female*	
	Length	*Breadth*	*Length*	*Breadth*
Head	0·67	0·43	0·68	0·46
Prothorax	..	0·27	..	0·30
Pterothorax	..	0·45	..	0·47
Abdomen	1·63	0·50	2·10	0·53
Total	2·92	..	3·40	..
Genitalia	0·70	..	..	..

Length of penis (number of specimens in brackets).

Anaticola crassicornis	0·13 mm. (1), 0·15 (7), 0·16 (1).
Anaticola anseris	0·27 mm. (3).

Neotype male (Figs. 23–24) and *neallotype* female (Fig. 25) of *Anaticola crassicornis* (Scopoli) from *Anas p. platyrhynchos* Linn., from NE. Poland (Meinertzhagen collection, slide No. 4242). *Neoparatypes*: 12 males and 20 females from same host-form, Poland, Hungary, and the British Isles.

Pediculus pilosus (p. 384)

The host is *Fulica atra* Linn., but all the description given is that the louse has a red head, a long abdomen, and a particularly hairy anus with the hairs parallel.

Although this description is extremely unsatisfactory and Harrison (1916: 17) rejected *pilosus* as unrecognizable, we think that the description of the anus can only apply (among coot-parasites) to a *Pseudomenopon*, and the other characters are not inconsistent with this identification. *Pseudomenopon* could certainly be described as having a red head and its abdomen is moderately elongate, much more so than that of *Incidifrons*, for instance, which seems the only alternative.

The species was redescribed as *Menopon tridens* by Burmeister (1838: 440) from material from the same host (*Fulica atra*); Piaget (1880: 480), wrongly taking *Gallinula chloropus* as the type-host of *tridens*, renamed the form from *Fulica atra* as *Menopon tridens* var. *major* (preoccupied by *Menopon quadrifasciatum* var. *major* Piaget 1880: 441); Eichler (1937: 97), noting that the name of Piaget's variety from the coot was preoccupied, renamed it *Pseudomenopon thompsoni*. Mjöberg (1910: 51) made *Menopon tridens* 'N.' the type-species of his genus *Pseudomenopon*.

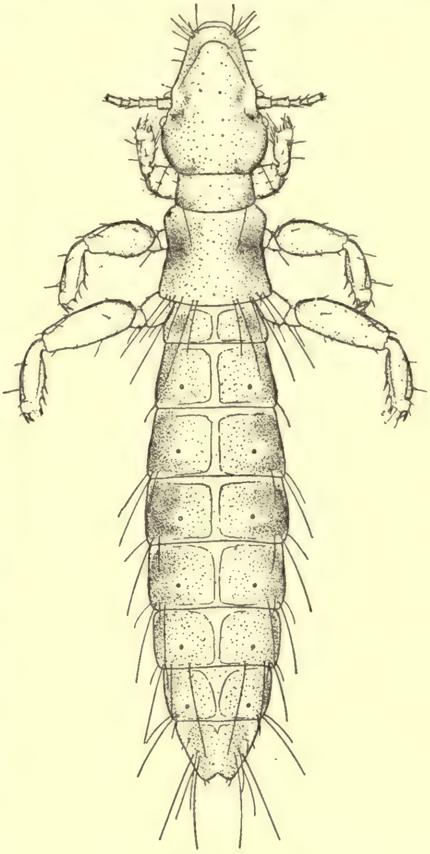


FIG. 25. *Anaticola crassicornis* (Scopoli), female.

Neotype male and *neallotype* female of *Pseudomenopon pilosum* (Scopoli) from *Fulica a. atra* Linn. from Ireland (Meinertzhagen collection, slide No. 16388). These specimens agree with the figures published by Ferris (1924, *Parasitology*, **16:** 64, fig. 4), although the male drawn by Ferris was from the American coot, *Fulica a. americana* Gmelin. The stout spine-like seta and the smaller seta below it on each side of the dorsal surface of the prothorax are not shown in fig. 4*a* (Ferris, 1924), nor are the three setae on each side of the dorsal surface of the metathorax. *Neoparatypes*: 12 males and 41 females from *Fulica a. atra* Linn., British Isles.

Neotype of *Pseudomenopon tridens* (Burmeister) a male (Meinertzhagen collection, slide No. 10510) from *Fulica a. atra* Linn. from Ireland. This specimen agrees with the neotype of *P. pilosum* (Scopoli).

The types of *Pseudomenopon thompsoni* Eichler (*Menopon* var. *major* Piaget 1880: 480 *nec* 441) are in the British Museum and also agree with the neotypes of *P. pilosum* (Scopoli).

Pediculus colymbinus (p. 384)

The host is *Colymbus auritus* Linn. (= *Podiceps auritus* (Linn.) of European authors), and Scopoli states that young specimens have an ovate abdomen with elliptical black dorsal spots and that the adult becomes rufous. This description is extremely inadequate, but the black dorsal spots (if not gut-contents) confine us to the Ischnocera and the only genus of Ischnocera reliably reported from the grebes is *Aquanirmus*. Denny (1842) described a *Nirmus fusco-marginatus* (a male *Aquanirmus*) from the same host and a *Nirmus podicepis* (a female of the same genus) from another

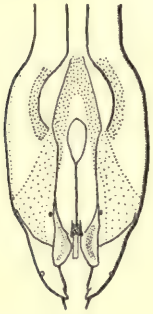


FIG. 26

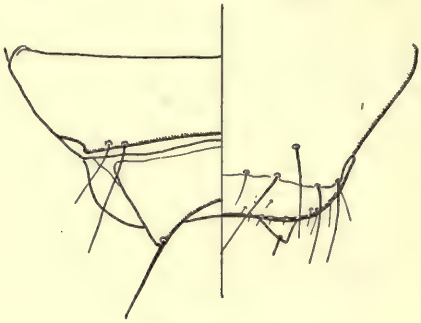


FIG. 27.

FIGS. 26–27. *Aquanirmus colymbinus* (Scopoli), male: 26. Genitalia. × 164. 27. Terminal segments of abdomen. × 223.

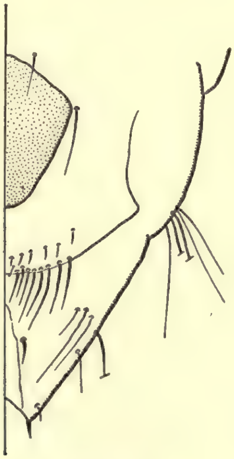


FIG. 28

FIG. 28. *Aquanirmus colymbinus* (Scopoli), terminal segments of female abdomen, ventral. × 208.

species of grebe, and later authors have identified what Scopoli considered to be young specimens with *N. podicepis* Denny. Although thinking the identification of *colymbinus* as an *Aquanirmus* far from certain, we see nothing in the description that disproves it and there is no object in disturbing the accepted application of Scopoli's name. We cannot accept the assumption that Denny's male and female are conspecific pending a much more careful examination of the forms occurring on different species of grebes than has yet been made, but the lectotype of *fusco-marginatus* Denny agrees with our male neotype of *colymbinus*.

Measurements in mm.

	Male		*Female*	
	Length	*Breadth*	*Length*	*Breadth*
Head . . .	0·46	0·35	0·53	0·42
Prothorax. . .	..	0·28	..	0·33
Pterothorax . .	..	0·37	..	0·45
Abdomen . . .	0·87	0·40	1·47	0·55
Total . . .	1·65	..	2·35	..
Genitalia . . .	0·37	..	..	..

Neotype male (Figs. 26–27; Pl. II, fig. 1) and *neallotype* female (Fig. 28; Pl. II, fig. 2) of *Aquanirmus colymbinus* (Scopoli) from *Colymbus auritus* Linn. from Devon, England (Meinertzhagen collection, slide No. 14736). *Neoparatypes*: 1 male and 6 females from the same host-form, England.

There are two males and one nymph of *Nirmus fusco-marginatus* from *Podiceps auritus* (= *Colymbus auritus*) in the Denny collection; one of these males (slide No. 349) is hereby selected as lectotype of *Aquanirmus fusco-marginatus* (Denny).

Pediculus ardealis (p. 384)

Harrison (1916: 11) wrongly considered this name to be a synonym of *Ardeicola ardeae* (Linn.), doubtless through misreading of the host-record '*Ardea Ciconia*' (= *Ciconia ciconia*). Of the species found on *Ciconia ciconia* (Linn.), Scopoli's very poor description could only apply to *Neophilopterus incompletus* (Denny) or to a nymph of *Ardeicola ciconiae* (Linn.). But, in addition to the description, Scopoli gives two references: to the less hairy figure on Frisch *Insect.* 5, pl. 4, and to Linné, 1758, p. 613, No. 26. The reference to Frisch is an obvious slip, for plate 4 only contains one insect, but the reference to Linné is to *Ardeicola ciconiae*, and under this species Linné refers to Frisch's plate 6; the latter plate does show two insects, one with hairs and the other without, both belonging to the genus *Ardeicola*. It is, therefore, certain that Scopoli's insect was the *Ardeicola* and not the *Neophilopterus*.

Neotype of *Ardeicola ardealis* (Scopoli) a male from *Ciconia c. ciconia* (Linn.) from South Africa (British Museum collection, slide No. 430) that agrees with the neotype of *Ardeicola ciconiae* (Linn.) (see Clay and Hopkins, 1950: 253).

Pediculus ovalis (p. 384)

The host is *Scolopax arquatus* and the description states that the louse is smaller than *Pediculus humanus*, has eight abdominal segments, and a depressed ovate body, the antennae are shorter than the head but longer than the thorax, and the colour is rufous-brown. No subsequent author has anything useful to say about the species, and Harrison (1916: 17) discards it as unrecognizable, but we claim that it is recognizable with certainty.

Admittedly there is no species on the curlew that agrees perfectly with Scopoli's description, and in particular none with an 8-segmented abdomen, but there are only three species normally found on this host that could possibly be described as rufous-brown and oval—a *Cummingsiella*, an *Austromenopon*, and perhaps *Saemundssonia humeralis* (Denny). Quite apart from the facts that the *Cummingsiella* fits the colour-character best and is by far the commonest of the three species (and therefore the most likely to have been observed by Scopoli), the description of the antenna convinces us that this is the form that Scopoli described. In the *Austromenopon* the antennae are concealed and the palps (sometimes mistaken for antennae in early descriptions) certainly do not project far enough beyond the margin of the head to be described as being longer than the thorax, but in the male of the *Cummingsiella* the antennae are almost as long as the thorax. This identification of Scopoli's species

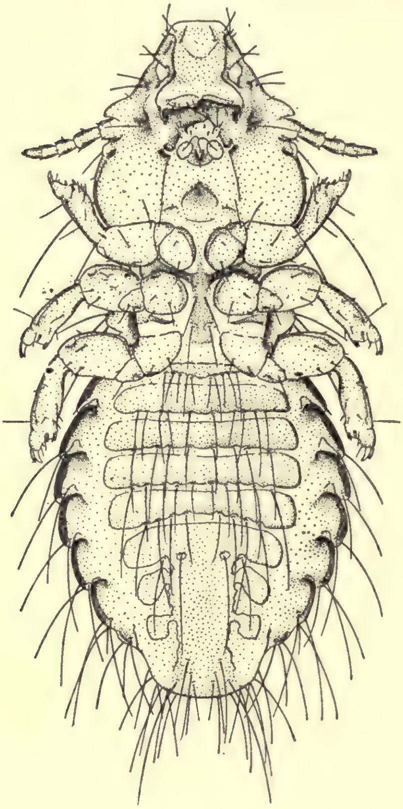


Fig. 29

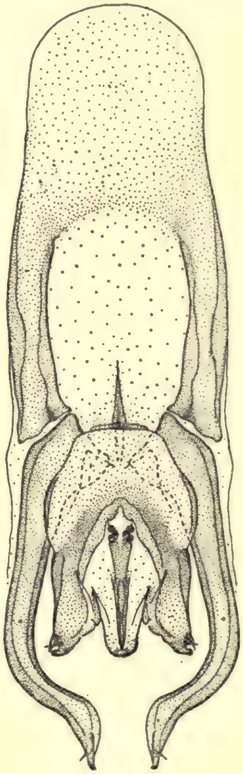


Fig. 30

Figs. 29–30. *Cummingsiella ovalis* (Scopoli): 29. Male. 30. Male genitalia.

involves the relegation of *Cummingsiella testudinaria* (Denny) to synonymy, but this is in any case inevitable because *Docophorus testudinarius* Denny and *D. biseriatis* Denny (the name used on p. 250 in Denny's explanation of his plate 1, fig. 6) are not independent names but merely misdeterminations of Children's *Nirmus testudinarius* and *N. biseriatus* and therefore invalid. The only other synonym of *Cummingsiella ovalis* (Scopoli) is *Nirmus pseudonirmus* Nitzsch.

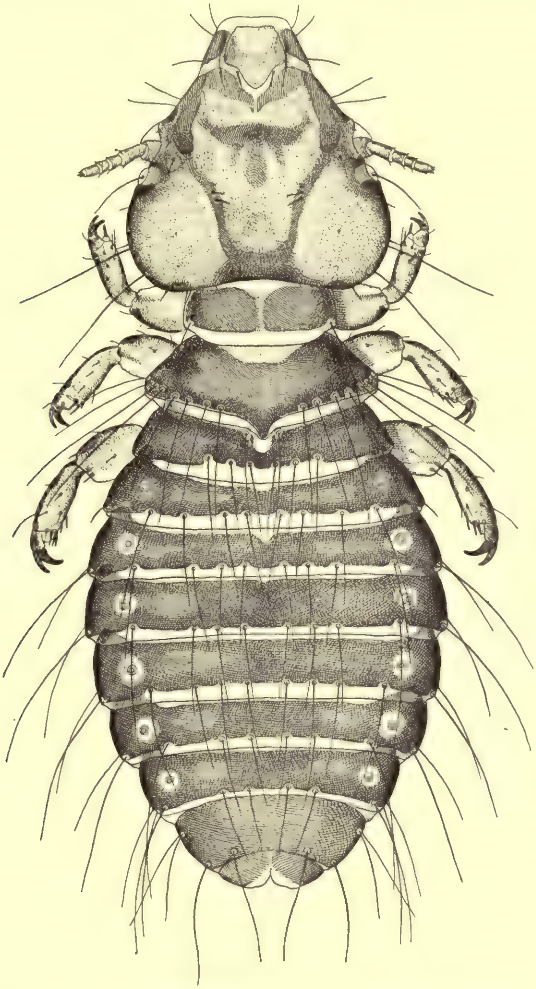


FIG. 31. *Cummingsiella ovalis* (Scopoli), female.

Neotype male (Figs. 29–30) and *neallotype* female (Fig. 31) of *Cummingsiella ovalis* (Scopoli) from *Numenius a. arquatus* (Linn.) from Yugoslavia (British Museum collection, slide No. 522). *Neoparatypes*: 86 males and 99 females from the same host-form, Yugoslavia, Hungary, and the British Isles.

Neotype of *Cummingsiella pseudonirmus* (Nitzsch) a male (British Museum (Natural

History), slide No. 523) from *Numenius a. arquatus* (Linn.) from Scotland, which agrees with the neotype of *C. ovalis* (Scopoli).

Measurements in mm.

	Male		*Female*	
	Length	*Breadth*	*Length*	*Breadth*
Head . . .	0·70	0·72	0·75	0·73
Prothorax. . .	..	0·42	..	0·45
Pterothorax . .	..	0·65	..	0·70
Abdomen . . .	1·16	1·03	1·50	1·11
Total . . .	2·10	..	2·56	..
Genitalia . . .	0·65	..	..	..

The Denny collection contains one male and two female *Cummingsiella* labelled *Docophorus testudinarius* but without host-record. These specimens agree with the neotypes of *C. ovalis* (Scopoli).

Pediculus junceus (p. 384)

The host is *Tringa vanellus* = *Vanellus vanellus* (Linn.), and the description is obviously that of a *Degeeriella s.l.* Denny (1842: 53, 143, pl. 9, fig. 5) made an identification of this species with which we are in full agreement; his specimens (3 females) came from the same host, although on p. 143 he added two other hosts. We do not agree with Harrison in considering *Pediculus tringae* Schrank 1803 (*nec* O. Fabricius, 1780) to be the present species, and it will be discussed separately. On the other hand, in spite of Schrank's definite statement (1803: 190) that his *Pediculus Vanelli*, from 'Kybize' (= *Vanellus vanellus*) is not Scopoli's insect we can find nothing in his description that supports this statement and suspect that the explanation must be that he misidentified *junceus*; our suspicion that this is the case is much strengthened by the fact that we have been unable to find any nirmoid species except *junceus* on *Vanellus vanellus*.

Measurements in mm.

	Male		*Female*	
	Length	*Breadth*	*Length*	*Breadth*
Head . . .	0·47	0·30	0·47	0·32
Prothorax. . .	..	0·22	..	0·22
Pterothorax . .	..	0·30	..	0·32
Abdomen . . .	0·93	0·41	1·03	0·45
Total . . .	1·64	..	1·82	..
Genitalia . . .	0·30	..	..	..

Neotype of *Quadraceps junceus* (Scopoli) a male (Fig. 32; Pl. II, fig.3) and *neallotype* a female (Fig. 33; Pl. II, fig. 4) from *Vanellus vanellus* (Linn.) from Italy (British Museum (Natural History), slide No. 524). *Neoparatypes*: 154 males and 140 females from the same host-form, Italy and the British Isles.

Pediculus cuspidatus (p. 385)

Denny (1842: 51, 130, pl. 6, fig. 2) redescribed as *Nirmus cuspidatus* a species that he took to be the same as that of Scopoli, though he thought it necessary to query the determination. Scopoli's host-record is '*Rallo aquat.*', and Denny's original specimen (no longer in his collection) evidently also came from *Rallus aquaticus* Linn., because this is the only host mentioned on p. 51. Scopoli's description is not by any means diagnostic, but so far as it goes it fits *Rallicola* at least as well as can be expected from these old descriptions. No subsequent author seems to have seen the species.

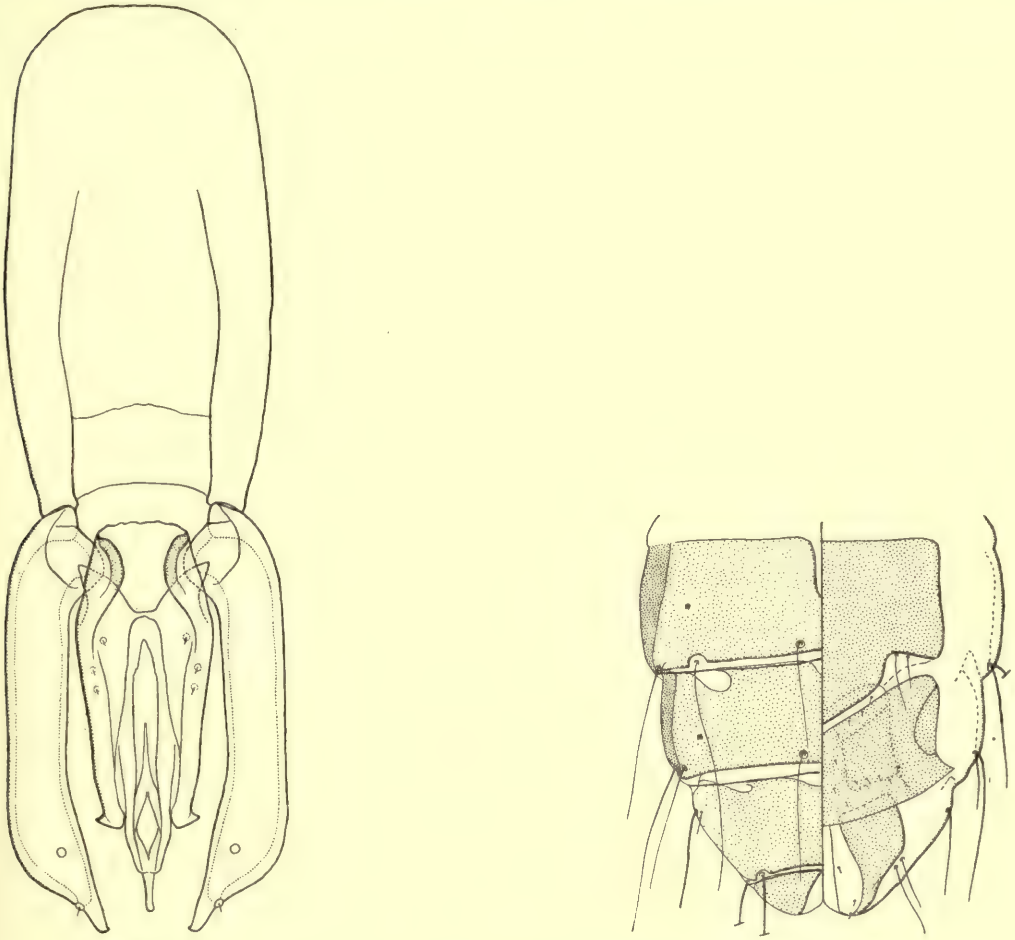


FIG. 32 FIG. 33

FIGS. 32–33. *Quadraceps junceus* (Scopoli): 32. Male genitalia. 33. Terminal segments of female abdomen. ×125.

Neotype male (Figs. 34–35; Pl. II, fig. 5) and *neallotype* female (Fig. 36; Pl. II, fig. 6) of *Rallicola cuspidatus* (Scopoli) from *Rallus a. aquaticus* Linn. from Kent, England (Meinertzhagen collection, slide No. 8332). *Neoparatypes*: 13 males and 48 females from the same host-form, British Isles.

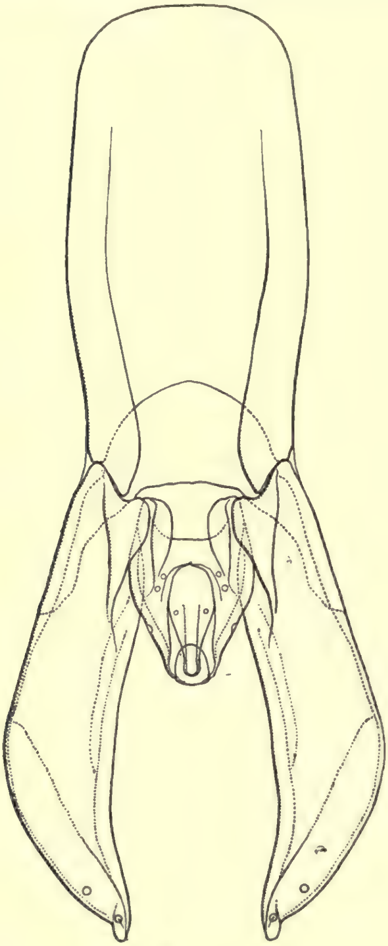


FIG. 34

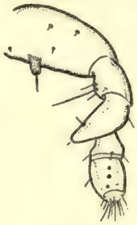


FIG. 35

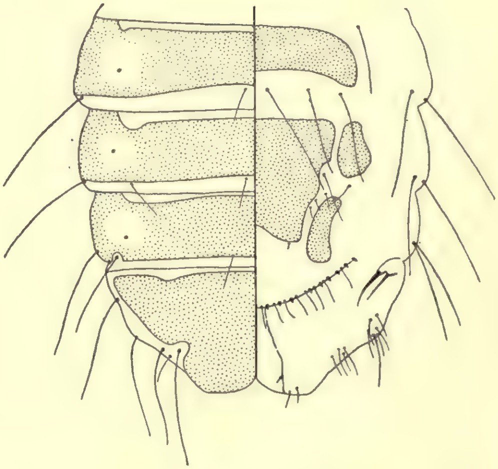


FIG. 36

FIGS. 34–36. *Rallicola cuspidatus* (Scopoli): 34. Male genitalia. 35. Male antenna. ×173. 36. Terminal segments of female abdomen. ×115.

Measurements in mm.

	Male		*Female*	
	Length	*Breadth*	*Length*	*Breadth*
Head . . .	0·37	0·30	0·42	0·35
Prothorax. . .	..	0·19	..	0·22
Pterothorax . .	..	0·27	..	0·30
Abdomen . . .	0·62	0·35	0·85	0·43
Total . . .	1·11	..	1·44	..
Genitalia . . .	0·25	..	..	..

Pediculus bidentatus (p. 385)

The host is *Columba palumbus* Linn., and the reference to a hemispherical head rules out all genera of Mallophaga known from European pigeons except *Coloceras* and *Campanulotes. Pediculus bidentatus* was constantly placed as a synonym of *Campanulotes compar* (Burmeister), from *Columba livia domestica,* until Harrison (1916) reversed this arrangement. Although we find nothing in the original description of *bidentatus* that enables us to decide which of the two genera Scopoli had before him, we think it best to accept this long-standing generic determination of his species.

This species is near *C. compar* (Burmeister) from *Columba livia,* from which it is distinguished by its greater size (see measurements below). The chaetotaxy and general characters are as figured by Kéler (1939: 158–160, figs. 89–91) for *C. compar* except that in fig. 89 a median ventral seta has been omitted on segments VI and VII; in fig. 90 the latero-dorsal temple spine has been omitted, the dorsal setae on abdominal segments II–III should be about twice as long as shown, and the median dorsal setae on segments V–VI have been omitted; and in fig. 91 the long ventral seta on the last abdominal segment has been omitted. The genital region of the female of *C. bidentatus* is shown in Fig. 37.

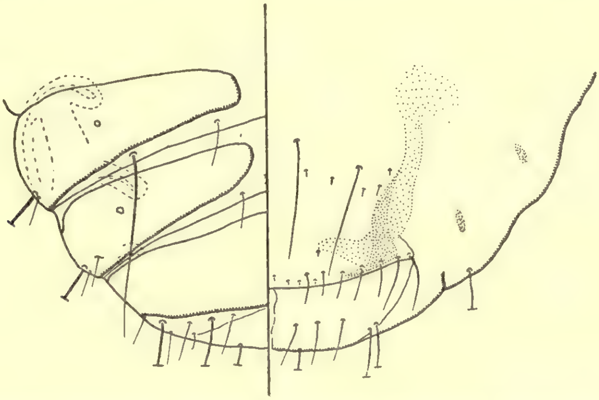


FIG. 37. *Campanulotes bidentatus* (Scopoli), terminal segments of female abdomen. × 121.

Measurements in mm.

	Male		*Female*	
	Length	*Breadth*	*Length*	*Breadth*
Head	0·34	0·47	0·43	0·53
Prothorax	..	0·29	..	0·34
Pterothorax	..	0·37	..	0·42
Abdomen	0·61	0·57	0·90	0·66
Total	1·20	..	1·58	..

Neotype of *Campanulotes b. bidentatus* (Scopoli) a male (Pl. III, fig. 1) and *neallotype* a female (Fig. 37) from *Columba p. palumbus* Linn. from Somerset, England (Meinertzhagen collection, slide No. 864). *Neoparatypes*: 63 males and 58 females from the British Isles.

Comparison of breadth of heads, in mm.

Species and No. of specimens	*Males*									
Breadth in mm.	*0·38*	*0·39*	*0·40*	*0·44*	*0·45*	*0·46*	*0·47*	*0·48*		
C. bidentatus compar	2	10	7	..	..	..	..	..		
C. bidentatus bidentatus	..	..	..	1	4	5	12	1		
	Females									
Breadth in mm.	*0·43*	*0·44*	*0·45*	*0·46*	*0·47*	*0·49*	*0·50*	*0·51*	*0·52*	*0·53*
C. bidentatus compar	1	4	5	8	2	..	..	..	..	..
C. bidentatus bidentatus	..	..	..	..	..	5	13	9	5	4

Pediculus albiventris (p. 385)

The original host-record is '*Motacilla Troglodyte*', which Harrison (1916: 87) wrongly took to mean *Motacilla* and *Troglodytes*, whereas only one species, the bird now known as *Troglodytes troglodytes* (Linn.), is mentioned. Clay and Meinertzhagen (1938: 73) showed that *Pediculus albiventris* (Scopoli) is the same as *Docophorus*

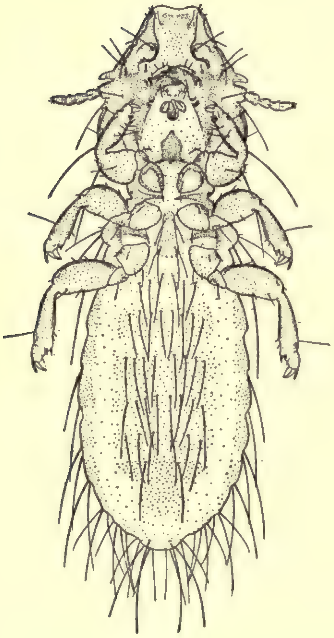


Fig. 38

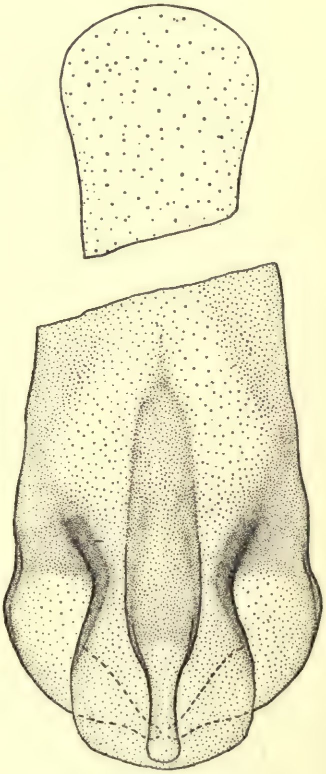


Fig. 39

Figs. 38–39. *Penenirmus albiventris* (Scopoli): 38. Male. 39. Male genitalia. ×600.

troglodytis (Waterston), from *Troglodytes troglodytes zetlandicus* Hartert, and made it the type species of *Penenirmus*. J. C. Fabricius (1776: 310) renamed the species *Pediculus motacillae*.

Measurements in mm.

	Male		*Female*	
	Length	*Breadth*	*Length*	*Breadth*
Head	0·42	0·37	0·48	0·45
Prothorax	..	0·20	..	0·25
Pterothorax	..	0·33	..	0·40
Abdomen	0·73	0·45	1·13	0·63
Total	1·33	..	1·85	..

Neotype of *Penenirmus albiventris* (Scopoli) a male (Figs. 38–39) and *neallotype* a female (Fig. 40) from *Troglodytes t. troglodytes* (Linn.) from Wiltshire, England (Meinertzhagen collection, slide No. 15399). *Neoparatypes*: 44 males and 52 females from various subspecies of *Troglodytes troglodytes* from the British Isles.

These neotypes are also automatically neotypes of *Penenirmus motacillae* (J. C. Fabricius)

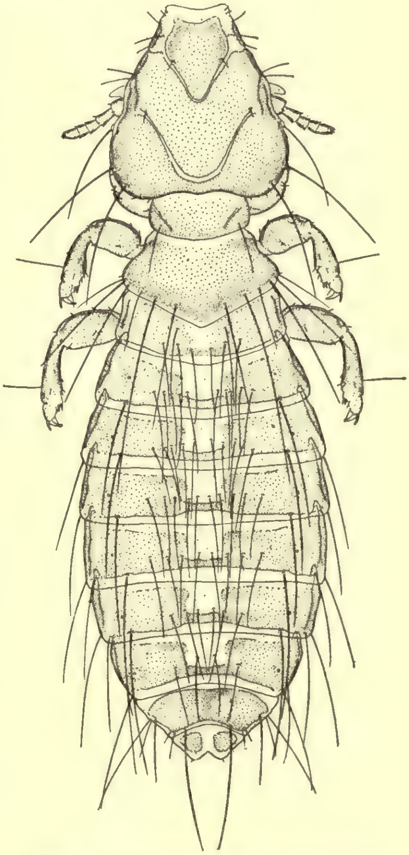


FIG. 40. *Penenirmus albiventris* (Scopoli), female.

PONTOPPIDAN, 1763 (*Den Danske Atlas.* **1** Kiöbenhavn: 699)

Only one of the names of Mallophaga published in this work is new.

Pediculus strigis (p. 699, pl. xxx)

This species is stated to be new and is described with a reference to plate xxx *b*, a figure of an obvious *Philopterus s.l.* There is no host-record other than that provided by the specific name. Before we go on to discuss the identity of the species it will be as well to consider the subsequent history of the name.

Scopoli (1772: 124) gives a completely independent description of a *Pediculus strigis* which is also clearly a *Philopterus s.l.*; there is no host-record, but as he describes a Hippoboscid from *Strix bubo* we think it nearly certain that this species was also the host of the louse. J. C. Fabricius (1775: 806) applied the name *Pediculus strigis* to *Pediculus haematopus* Scopoli, Fabricius's *nomen novum* thus being not only unnecessary but twice preoccupied, to say nothing of the fact that *haematopus* (and therefore *strigis* Fabricius) is not from an owl but from a hawk. Müller (1776: 185) mentioned the name with a reference to

'P.D.A.' (= Pontoppidan's *Danske Atlas*). O. Fabricius (1780: 216) gave references to Pontoppidan and Müller and also an independent description of the differences between his material (from *Strix nyctea*) and Pontoppidan's plate. Harrison (1916: 18) did not know *strigis* Pontoppidan and rejected all the other uses of the name as either unrecognizable or preoccupied. The position may be summarized as follows:

P. strigis Pontoppidan is a valid name and easily determinable to the genus.

P. strigis Scopoli may or may not be Pontoppidan's species but is certainly congeneric.

P. strigis J. C. Fabricius is an unwanted *nomen novum* for *Pediculus* (now *Craspedorrhynchus*) *haematopus* Scopoli. It is twice preoccupied and is not congeneric with the others.

P. strigis 'Müller' does not exist, Müller merely listing Pontoppidan's species.

P. strigis O. Fabricius is partly a reference to Pontoppidan and partly a new species, the name of the latter thrice preoccupied.

In the circumstances it seems to us that much the most satisfactory course is to fix *strigis* Pontoppidan in such a way that it is the same as *strigis* Scopoli and (if possible) so that its restoration does not upset any well-established name of later date. Not only does *Bubo bubo*, which we consider to be the host of Scopoli's species, occur in Denmark, but Pontoppidan definitely described another parasite from this host, so that it is very probable that his louse came from this species of bird. Two species of *Strigiphilus* occur on *Bubo bubo*, one of which has long been known as *S. heteroceros* (Nitzsch) whereas the other had not been named until Eichler (1949: 14) named it '*Neodocophorus' hopkinsi*, though it is probably a component of *S. cursor* (Burmeister) as described by Giebel (1874: 70). The first species, however, cannot retain the name *Strigiphilus heteroceros* (Nitzsch), because this species was not described until 1861 whereas Grube used the same name (*Docophorus heterocerus*) for a species found on *Strix uralensis liturata* Tengmalm ten years earlier (Grube, 1851: 469). Eichler (1949: 11) has correctly pointed out this fact and renamed the species with sexually dimorphic antennae found on *Bubo bubo* as *Strigiphilus goniodicerus*. Both the species concerned have, therefore, been named and both the names are of equal seniority, so it does not matter to which species we apply the name *strigis* Pontoppidan (his figure applying fairly well to either), so we have selected *hopkinsi* to bear Pontoppidan's name.

Measurements in mm.

	Male	
	Length	*Breadth*
Head	0·69	0·63
Prothorax	..	0·40
Pterothorax	..	0·56
Abdomen	0·94	0·84
Total	1·93	..
Genitalia	0·47	..

This species is distinguished from *S. goniodicerus* Eichler, from the same host, by the antennae being similar in the two sexes and by the smaller and less complicated male genitalia. Although there are two species of females represented in the available material it has not been possible to assign them with certainty to the males, so no neallotype or female neoparatypes have been erected.

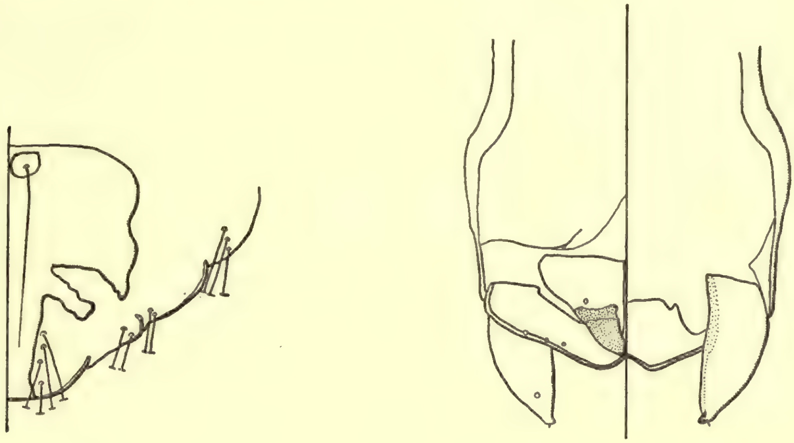


FIG. 41 FIG. 42

FIGS. 41–42. *Strigiphilus strigis* (Pontoppidan), male: 41. Terminal segments of abdomen. ×74. 42. Genitalia. ×294.

Neotype of *Strigiphilus strigis* (Pontoppidan) a male (Figs. 41–42, Pl. III, fig. 2) from *Bubo bubo* (Linn.) from Russia (Meinertzhagen collection, slide No. 10975*a*). *Neoparatypes*: 9 males from the same host-form, Russia and Italy (captive host).

Neotype of *Strigiphilus strigis* (Scopoli) a male (Meinertzhagen collection, slide No. 10975*b*) from *Bubo bubo* (Linn.) from Russia, that agrees with the neotype of *Strigiphilus strigis* (Pontoppidan).

SCOPOLI, 1772 (*Annus V Historico-Naturalis*. [PC.] 5. *Observationes Zoologicae*. Lipsiae: 124–125)

The descriptions in this work are very poor. Fortunately they are also very few.

Pediculus hirci junioris (p. 124)

We only mention this name because we feared at first that it might be the earliest name for a chewing louse of the goat. But we are certain that the description does not refer to a member of the Mallophaga and we think it likely that the insect was one of the Anoplura.

Pediculus strigis (p. 124)

This name has been dealt with under *Pediculus strigis* Pontoppidan and a neotype has been erected. *Strigiphilus strigis* (Scopoli) is both a homonym and a synonym of *S. strigis* (Pontoppidan).

Pediculus ralli (p. 125)

There is no host-record other than that provided by the specific name, but the host must be assumed to have been some bird that occurs in Carniolia and was included in the genus *Rallus* in Scopoli's time.

The entire description is that the head of the insect is bidentate and the abdomen glabrous, with pilose and crenate sides. Among parasites of the Rallidae this description could only apply to the genus *Incidifrons*, but as we have not seen this genus from any bird that complies with the conditions we have mentioned as necessary assumptions we are unable to erect a neotype for the species. We think it of the first importance that *Incidifrons ralli* (Scopoli) should eventually be fixed in such a way that *Incidifrons ralli* (Denny) becomes a synonym as well as a homonym, thus avoiding the confusion that would be caused by the transfer of the name *ralli* from one species to another. We therefore intend to assume in all future work that the host of *Incidifrons ralli* (Scopoli), like that of *I. ralli* (Denny), was *Rallus a. aquaticus* Linn., and we most strongly urge other workers to make the same assumption. There are no specimens of *I. ralli* in the Denny collection.

Pediculus fringillae (p. 125)

The entire description is that the head is bidentate and the sides of the abdomen are pilose and rugose, but among parasites of the birds included in *Fringilla* in Scopoli's time only *Philopterus* fits this description. There is no host-record other than that provided by the name, so we have chosen as host of our neotype one of the commoner birds included by Scopoli in *Fringilla*, namely, *Fringilla domestica*, now known as *Passer domesticus* Linn.[1]

We hope that our action will finally settle the confusion that has arisen (as shown in Part I of this work (Clay and Hopkins, 1950: 270)) through the application of Geoffroy's invalid appellation '*subflavescens*' to the *Philopterus* from this host. Fourcroy (1785: 519) gave the name *Pediculus passeris* to the species described by Geoffroy, and *Philopterus passeris* (Fourcroy) and *P. passeris* (Piaget) (together with *subflavescens* of authors subsequent to Geoffroy) become synonyms of *Philopterus fringillae* (Scopoli).

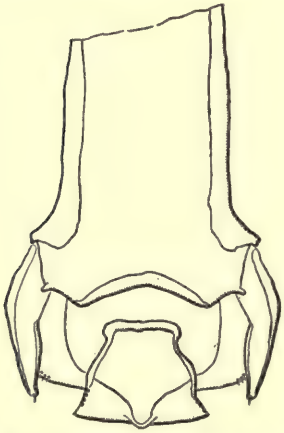


FIG. 43. *Philopterus fringillae* (Scopoli), male genitalia. ×319.

This species has been discussed above under *P. coarctatus* (Scopoli) 1763, from which it differs in having a median indentation in the hyaline margin of the head, and in the characters of the male genitalia and female genital plate.

Neotype male (Fig. 43; Pl. III, fig. 3; Tables 1 and 3) and *neallotype* female (Fig. 44; Tables 2 and 4–5) of *Philopterus fringillae* (Scopoli) from *Passer d. domesticus* (Linn.)

---

[1] This host is not given in the publication under discussion, in which no species of *Fringilla* are mentioned, but in Part I of the same work, published in 1769, Scopoli refers to *Fringilla domestica* on p. 149.

from Hungary (Meinertzhagen collection, slide No. 8077*a*). *Neoparatypes*: 47 males and 57 females from the same host-form, Hungary, Estonia, and the British Isles.

Measurements in mm.

	Male		*Female*	
	Length	*Breadth*	*Length*	*Breadth*
Head	0·55	0·50	0·58	0·56
Prothorax	..	0·29	..	0·32
Pterothorax	..	0·45	..	0·50
Abdomen	0·70	0·68	1·02	0·91
Total	1·45	..	1·85	..
Genitalia	0·31	..	..	..

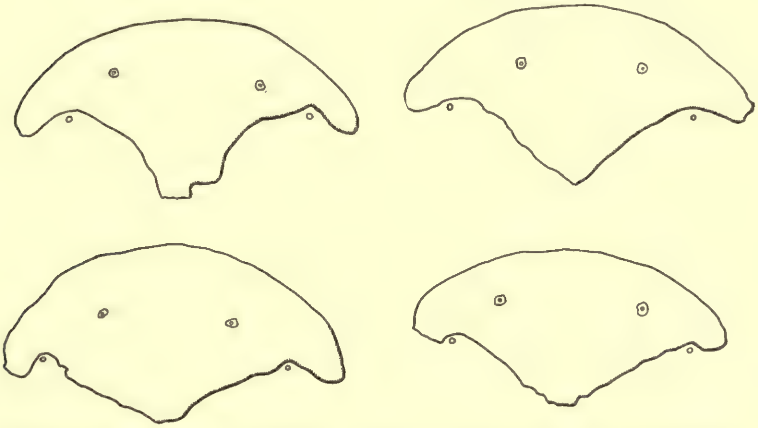


FIG. 44. *Philopterus fringillae* (Scopoli), genital plates of 4 females taken from one host individual. × 102.

Pediculus pari palustris (p. 125)

'Cauda quadriseta, ut in *P. Pari majoris* Linn.' As no differences from Linné's species are mentioned we consider this to be a *nomen nudum*, but in any case the name clearly does not refer to the Mallophaga but to a mite.

J. C. FABRICIUS, 1775 (*Systema Entomologiae.* Flensburgi et Lipsiae: 804–810)

The great majority of the names mentioned in this work have already been dealt with, being either quoted from Linné or entirely unnecessary renamings of Scopoli's species, with descriptions quoted from the latter author. Only the following are genuinely new:

Pediculus vulturis (p. 806)

The description is quite obviously that of a *Laemobothrion*, but the host-record is merely 'Habitat in Indiae orientalis vulturibus'. In these circumstances the most reasonable procedure seems to be to attach the name to a *Laemobothrion* from one of the Indian vultures. We have chosen *Pseudogyps bengalensis* (Gmelin).

This species differs from *L. tinnunculi* (Linn.) (see Clay and Hopkins, 1950: 228) in the larger size, the shape of the head (Pl. III, figs. 4, 6), in the greater number of prosternal setae[1] and the shape of the sternal plates (Fig. 45), the presence of a line of setae on the lateral margins of the sternal plates, and in details of the male genitalia. No material of *Laemobothrion maximum* (Scopoli) has been seen from *Buteo buteo*, but from Eichler's figures (1941: 363, fig. 28; 1942: 59, fig. 4), and examination of specimens (possibly not conspecific with *maximum*) from other species of *Buteo*, it seems to differ from *vulturis* in the smaller size, the smaller number of prosternal setae, the shape of the prosternal plate, and possibly in the details of the male genitalia.

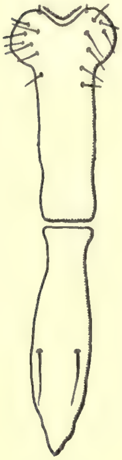


FIG. 45. *Laemobothrion vulturis* (J. C. Fabricius), female sternal plates. ×31.

Measurements in mm.

	Male		*Female*	
	Length	*Breadth*	*Length*	*Breadth*
Head*	1·52	1·70	1·56	1·80
Abdomen	5·76	2·48	6·92	3·02
Total	9·24	..	10·56	..
Genitalia	2·90	..	..	..

* The head is liable to distortion in mounted specimens of *Laemobothrion* and throughout the genus these measurements may show considerable variation in one species.

Neotype male (Pl. III, figs. 4–5) and *neallotype* female (Fig. 45; Pl. III, fig. 6) of *Laemobothrion vulturis* (J. C. Fabricius) from *Pseudogyps bengalensis* (Gmelin) from Deccan, India (Meinertzhagen collection, slide No. 8607). *Neoparatypes*: 1 male and 2 females from the same host-form, Deccan and Siam.

Pediculus procellariae (p. 808)

An elongate, filiform, fuscous species occurring 'in Brasiliae procellariis' can only be a *Halipeurus* or a *Perineus*, the former being the more probable identification because members of this genus are more elongate than those of *Perineus* (Fabricius seems to have been particularly impressed by this character) and also more fuscous. But in view of the number of species of petrels which occur in Brazilian waters the selection of host must be purely arbitrary. Mr. R. L. Edwards informs us that in a paper he is about to publish he will redescribe *Halipeurus procellariae* (J. C. Fabricius) from specimens taken from *Pterodroma m. macroptera* (A. Smith). *Halipeurus constrictiventris* (Pessôa and Guimarães) 1935 will thus become a synonym of *H. procellariae*.

Pediculus diomedeae (p. 808)

One of us (Clay, 1940: 300–302) has already discussed this species and erected neotypes from *Diomedea m. melanophris* Temminck. It is perhaps as well to repeat that it is a *Perineus*, not a *Harrisoniella*, has nothing to do with *Harrisoniella ferox* (Giebel), and that the type species of *Harrisoniella* is *Esthiopterum diomedeae* Harrison 1916 (*nec* J. C. Fabricius 1775) (= *Lipeurus ferox* Giebel).

---

[1] Examination of further material suggests that this is an unreliable character owing to individual variation. See Part III (in press) for further notes on *Laemobothrion vulturis*.

Pediculus hirundinis (p. 810)

We have noted above (Clay and Hopkins, 1950: 26) that this name must be ascribed to Linné and have discussed it under that author.

TABLES 1–5, MEASUREMENTS OF *PHILOPTERUS* SPECIES

TABLE 1. *Breadth (in mm.) of head at temples of males, with number of specimens*

	0·45–0·46	*0·47–0·48*	*0·49–0·50*	*0·51–0·52*	*0·53–0·54*	*0·55–0·56*
coarctatus	..	6	17	4	..	..
fringillae	..	..	3	15	7	2
citrinellae	3	22	2	..	..	..

TABLE 2. *Breadth (in mm.) of head at temples of females, with number of specimens*

	0·47–0·48	*0·49–0·50*	*0·51–0·52*	*0·53–0·54*	*0·55–0·56*	*0·57–0·58*	*0·59–0·60*	*0·61–0·62*
coarctatus	..	..	3	5	4	18	..	..
fringillae	..	..	..	2	6	13	4	5
citrinellae	1	3	6	16	4	..	..	..

TABLE 3. *Cephalic index of males, with number of specimens*

	0·90–0·91	*0·92–0·93*	*0·94–0·95*	*0·96–0·97*	*0·98–0·99*	*1·00–1·01*	*1·02–1·03*
coarctatus	3	10	7	7	..	..	3
fringillae	..	2	5	10	3	4	..
citrinellae	4	10	9	3	1	..	..

TABLE 4. *Cephalic index of females, with number of specimens*

	0·90–0·91	*0·92–0·93*	*0·94–0·95*	*0·96–0·97*	*0·98–0·99*	*1·00–1·01*	*1·02–1·03*	*1·04–1·05*
coarctatus	3	5	11	4	6	1	..	..
fringillae	..	1	4	7	7	7	3	1
citrinellae	2	8	11	7	2	..	..	..

TABLE 5. *Ratio of breadth: length of female genital plate, with number of specimens in parentheses*

coarctatus . . . . . 1·38 (1), 1·45 (1), 1·53 (2), 1·54 (1), 1·55 (1), 1·58 (1), 1·59 (1), 1·69 (2), 1·75 (1).
fringillae . . . . . 1·79 (1), 1·88 (3), 1·91 (1), 1·94 (2), 2·00 (3), 2·10 (1).

LIST OF SPECIES

The synonymy of the following names has been established.

Specific name	*Present status*	*Page*
albiventris Scopoli.	*Penenirmus albiventris* (Scopoli).	28
anatis Fabricius.	*Anaticola crassicornis* (Scopoli).	17

Specific name	*Present status*	*Page*
ardealis Scopoli.	*Ardeicola ciconiae* (Linn.).	21
auritus Scopoli.	*Penenirmus auritus* (Scopoli).	15
bidentatus Scopoli.	*Campanulotes bidentatus* (Scopoli).	27
biseriatis Denny.	*Cummingsiella ovalis* (Scopoli).	23
buteonis Fabricius.	*Laemobothrion maximum* (Scopoli).	5
coarctatus Scopoli.	*Philopterus coarctatus* (Scopoli).	6
collurionis Schrank.	*Philopterus coarctatus* (Scopoli).	6
colymbinus Scopoli.	*Aquanirmus colymbinus* (Scopoli).	20
constrictiventris Pessôa & Guimarães.	*Halipeurus procellariae* (Fabricius).	34
cornicis Fabricius.	*Philopterus ocellatus* (Scopoli).	10
crassicornis Scopoli.	*Anaticola crassicornis* (Scopoli).	17
cuculi Fabricius.	*Cuculiphilus fasciatus* (Scopoli).	13
cuspidatus Scopoli.	*Rallicola cuspidatus* (Scopoli).	25
dentatus Scopoli.	*Anatoecus dentatus* (Scopoli).	15
diomedeae Fabricius.	*Perineus diomedeae* (Fabricius).	34
dolichocephalus Scopoli.	*Ricinus dolichocephalus* (Scopoli).	10
fasciatus Scopoli.	*Cuculiphilus fasciatus* (Scopoli).	13
fringillae Scopoli.	*Philopterus fringillae* (Scopoli).	32
fusco-marginatus Denny.	*Aquanirmus colymbinus* (Scopoli).	21
gigantum Nitzsch.	*Laemobothrion maximum* (Scopoli).	5
haematopus Scopoli.	*Craspedorrhynchus haematopus* (Scopoli).	4
junceus Scopoli.	*Quadraceps junceus* (Scopoli).	24
lanii Fabricius.	*Philopterus coarctatus* (Scopoli).	6
maximus Scopoli.	*Laemobothrion maximum* (Scopoli).	5
motacillae Fabricius.	*Penenirmus albiventris* (Scopoli).	29
ocellatus Scopoli.	*Philopterus ocellatus* (Scopoli).	8
orioli Fabricius.	*Ricinus dolichocephalus* (Scopoli).	13
ovalis Scopoli.	*Cummingsiella ovalis* (Scopoli).	21
passeris Fourcroy.	*Philopterus fringillae* (Scopoli).	32
passeris Piaget.	*Philopterus fringillae* (Scopoli).	32
phanerostigma Giebel.	*Cuculiphilus fasciatus* (Scopoli).	13
phanerostigmaton Nitzsch.	*Cuculiphilus fasciatus* (Scopoli).	13
pilosus Scopoli.	*Pseudomenopon pilosum* (Scopoli).	19
platyrhynchus Nitzsch.	*Craspedorrhynchus haematopus* (Scopoli).	5
procellariae Fabricius.	*Halipeurus procellariae* (Fabricius).	34
pseudonirmus Nitzsch.	*Cummingsiella ovalis* (Scopoli).	23
ralli Scopoli.	*Incidifrons ralli* (Scopoli).	32
ralli Denny.	*Incidifrons ralli* (Scopoli).	32
squalidus Nitzsch.	*Anaticola crassicornis* (Scopoli).	18
strigis Pontoppidan.	*Strigiphilus strigis* (Pontoppidan).	29
strigis Scopoli.	*Strigiphilus strigis* (Pontoppidan).	31
strigis Fabricius.	*Craspedorrhynchus haematopus* (Scopoli).	5
subflavescens auctorum.	*Philopterus fringillae* (Scopoli).	32
sulphureum Nitzsch.	*Ricinus dolichocephalus* (Scopoli).	13
superciliosus Burmeister.	*Penenirmus auritus* (Scopoli).	15
testudinarius Denny.	*Cummingsiella ovalis* (Scopoli).	24
thompsoni Eichler.	*Pseudomenopon pilosum* (Scopoli).	19
tinnunculi Latreille.	*Craspedorrhynchus haematopus* (Scopoli).	4
tridens Burmeister.	*Pseudomenopon pilosum* (Scopoli).	19
tridens var. *major* Piaget.	*Pseudomenopon pilosum* (Scopoli).	19
troglodytis Waterston.	*Penenirmus albiventris* (Scopoli).	29
vanelli Schrank.	*Quadraceps junceus* (Scopoli).	24
vulturis Fabricius.	*Laemobothrion vulturis* (Fabricius).	34

REFERENCES

Only those papers not referred to in Part I are listed here.

CLAY, T. 1940. Anoplura. *British Graham Land Exped. Sci. Rep.* (Brit. Mus. (Nat. Hist.)), **1:** 295–318.

—— & HOPKINS, G. H. E. 1950. The Early Literature on Mallophaga. Pt. I. *Bull. Brit. Mus.* (*Nat. Hist.*) *Ent.* **1** (3): 223–272.

EICHLER, W. 1941. Zur Klassifikation der Lauskerfe. *Arch. Naturgesch.* B (N.F.), **10:** 345–398.

—— 1942. Mallophagen-Synopsis.—III. Genus *Laemobothrion. Zool. Anz.* **137:** 52–63.

—— 1946. Mallophagen-Synopsis.—VIII. Genus *Anatoecus. Tijdschr. Ent.* **87:** 74–76.

—— 1949. Die Eulenfederlinge. *Beitr. Taxon. Zool.* **1:** 7–22.

KÉLER, S. 1938. Baustoffe zu einer Monographie der Mallophagen.—I. Teil. *Nova Acta Leop. Carol.* (N.F.), **5:** 385–467.

—— 1939. Baustoffe zu einer Monographie der Mallophagen.—II. Teil. *Nova Acta Leop. Carol.* (N.F.), **8:** 1–254.

—— 1941. Systematisches Verzeichnis der von Nitzsch begründeten und von Giebel und Taschenberg fortgeführten und bereicherten Sammlung von Mallophagen des Zoologischen Instituts der Universität Halle. *Z. Naturw.* **95:** 123–136.

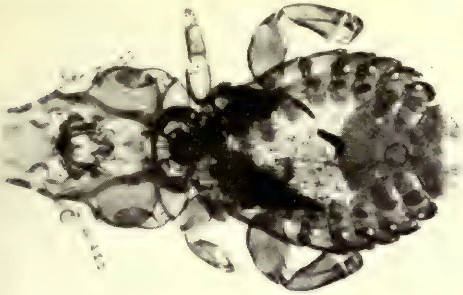
MERISUO, A. K. 1945. Notulae Mallophagologicae.—II. *Ann. Ent. Fenn.* **11:** 101–112.

WATERSTON, J. 1915. On some Mallophaga in the Kgl. Zool. Museum, Königsberg. *Zool. Jb.* (*Abt. Syst.*), **39:** 17–42.

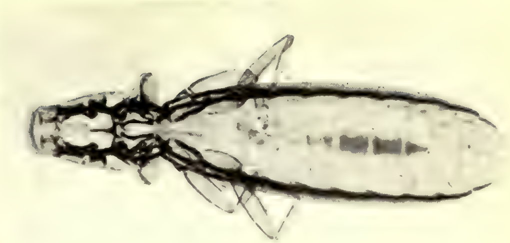
PRESENTED
17 DEC 1951

PLATE 1

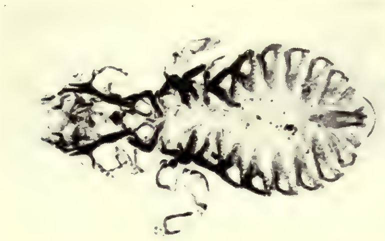
Fig. 1. *Philopterus coarctatus* (Scopoli), ♀.
Fig. 2. *Philopterus ocellatus* (Scopoli), ♂.
Fig. 3. *Ricinus dolichocephalus* (Scopoli), ♀.
Fig. 4. *Penenirmus auritus* (Scopoli), ♂.
Fig. 5. *Anatoecus dentatus* (Scopoli), ♂.



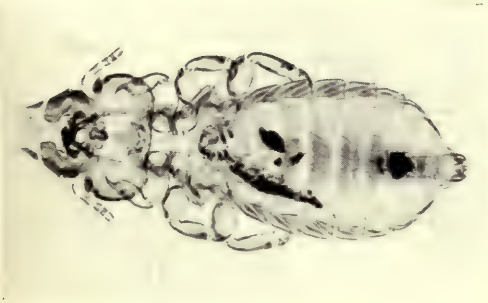
1



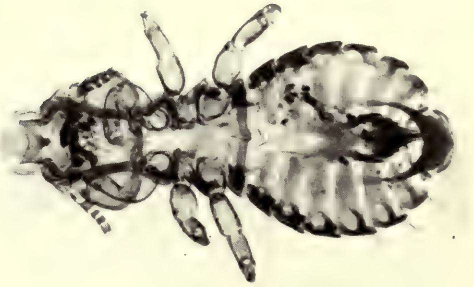
3



2



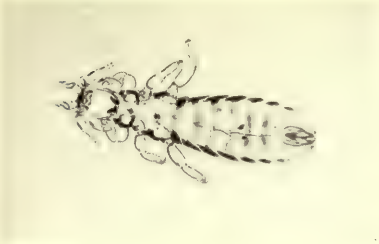
4



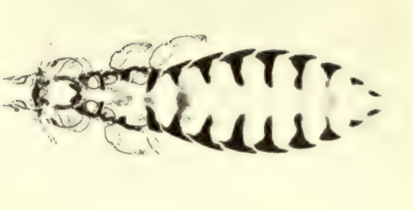
5

PLATE 2

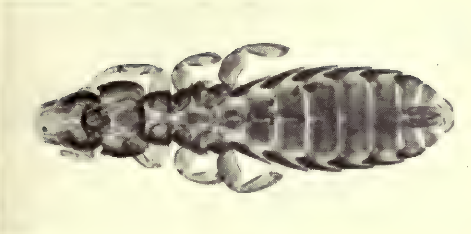
Fig. 1. *Aquanirmus colymbinus* (Scopoli), ♂.
Fig. 2. *Aquanirmus colymbinus* (Scopoli), ♀.
Fig. 3. *Quadraceps junceus* (Scopoli), ♂.
Fig. 4. *Quadraceps junceus* (Scopoli), ♀.
Fig. 5. *Rallicola cuspidatus* (Scopoli), ♂.
Fig. 6. *Rallicola cuspidatus* (Scopoli), ♀.



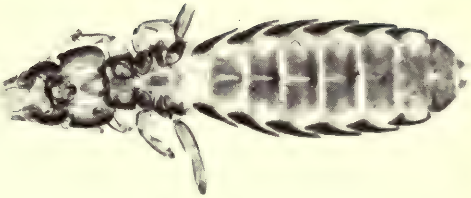
1



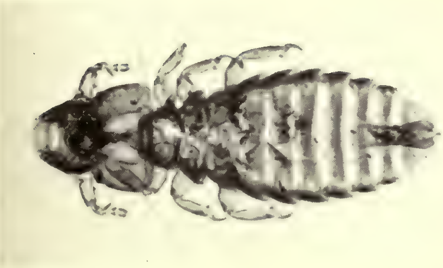
2



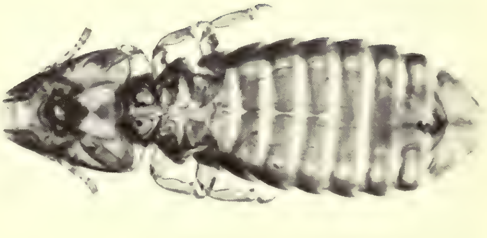
3



4



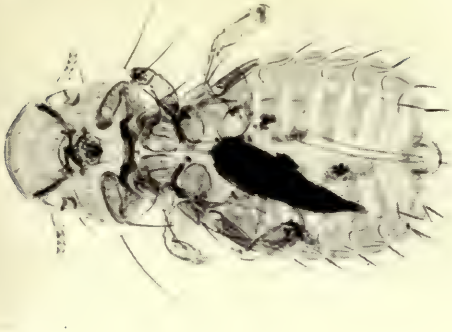
5



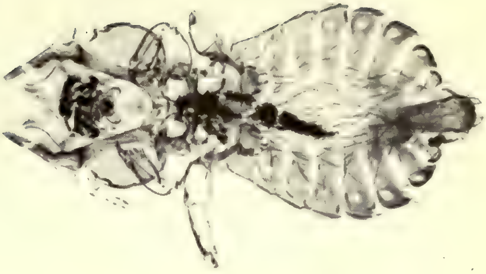
6

PLATE 3

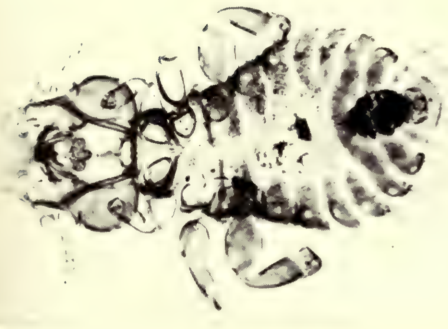
Fig. 1. *Campanulotes bidentatus* (Scopoli), ♂.
Fig. 2. *Strigiphilus strigis* (Pontoppidan), ♂.
Fig. 3. *Philopterus fringillae* (Scopoli), ♂.
Fig. 4. *Laemobothrion vulturis* (J. C. Fabricius), ♂.
Fig. 5. *Laemobothrion vulturis* (J. C. Fabricius), ♂ genitalia.
Fig. 6. *Laemobothrion vulturis* (J. C. Fabricius), ♀.



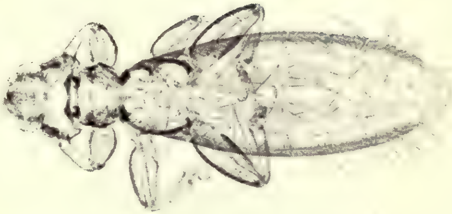
1



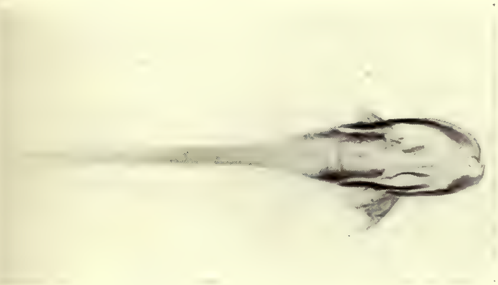
2



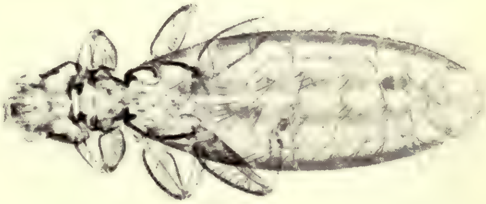
3



4



5



6

BRITISH MUSEUM NATURAL HISTORY
PRESENTED
1 7 DEC 1951

PRINTED IN
GREAT BRITAIN
AT THE
UNIVERSITY PRESS
OXFORD
BY
CHARLES BATEY
PRINTER
TO THE
UNIVERSITY

17 DEC 1952

A REVISION OF THE AUSTRALIAN AND TASMANIAN GRIPOPTERYGIDAE AND NEMOURIDAE (PLECOPTERA)

D. E. KIMMINS

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 2 No. 2
LONDON : 1951

A REVISION OF THE AUSTRALIAN AND TASMANIAN GRIPOPTERYGIDAE AND NEMOURIDAE (PLECOPTERA)

BY

D. E. KIMMINS

Pp. 43–93; 40 *Text-figures*

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 2 No. 2
LONDON : 1951

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in 1949, is issued in five series, corresponding to the Departments of the Museum.*

Parts appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, No. 2, of the Entomology series.

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued December 1951 *Price Ten shillings*

A REVISION OF THE AUSTRALIAN AND TASMANIAN GRIPOPTERYGIDAE AND NEMOURIDAE (PLECOPTERA)

By D. E. KIMMINS

SYNOPSIS

In this paper sixteen new species of the family Gripopterygidae and four in the family Nemouridae are described. The Australian species of Nemouridae are transferred to the subfamily Notonemourinae Ricker, containing nine genera with a distribution ranging over Australia, Tasmania, New Zealand, southern South America, and Cape Province, South Africa. The type of the genus *Leptoperla* Newman has been studied and redescribed, with the result that a later genus described by Enderlein must fall into synonymy. In addition, the nymphs of three genera of the Gripopterygidae are described and figured.

THE Gripopterygidae are the dominant Plecopterous family in Australia and New Zealand; Tillyard gave ten as the number of Australian and Tasmanian species, a figure which included some undescribed species in his collection, as only eight species had then been published, contained in five genera. Examination of the British Museum accessions and the Tillyard collection has enabled this list to be increased by sixteen new species and the genera to be reduced to four.[1] In addition, it has been possible to describe the nymphs of three of the genera, and it is highly probable that there are still more species to be described, as more than one species of *Trinotoperla* nymph has been recognized from Tasmania, whence no adult has yet been recorded. Apart from Australia, Tasmania, and New Zealand, this family also occurs in the Fiji Islands, Auckland Islands, and the colder, mountainous parts of South America.

The Nemouridae are represented in Australia and Tasmania by five species (four here described for the first time), in two genera. For these insects Dr. Ricker's subfamily name Notonemourinae is adopted. This subfamily is not restricted to Australia and New Zealand, but occurs also in southern South America and in the mountain ranges of Cape Province, South Africa. In the latter region they are the dominant Plecoptera, seventeen species in four genera being listed by Barnard, the only other Plecoptera recorded being two sub-tropical Perlidae. Further collecting in Australia should produce more species, their small size and dull colouring no doubt causing them to be overlooked, but according to Tillyard they are decidedly less common than the Gripopterygidae.

It is difficult to understand why this nemourid subfamily should have established itself so securely in the mountains of Cape Province, whereas the Gripopterygidae, which occur with it in other regions, are apparently absent. This absence would not seem to be due to lack of collecting, as Tillyard asked Dr. Barnard to make a special search in this region in the hope of finding examples of Gripopterygidae. Fossil records may show whether this family did ever exist in the Cape, but if they did, they appear to have died out. The South African Notonemourinae would appear to have been isolated for a longer period than the Australian and South American forms, as all the four South African genera are absent from the other regions. *Udamocercia* occurs in South America and Tasmania, two genera are known only from New Zealand, and *Spaniocerca* occurs in Australia, Tasmania, and New Zealand.

---

[1] Unless otherwise stated, types of the new species are in the British Museum (Nat. Hist.).

GRIPOPTERYGIDAE Enderlein

Gripopterygidae Enderlein, 1909, *Zool. Anz.* **34:** 388.
Leptoperlini Banks, 1913, *Trans. Amer. Ent. Soc.* **39:** 202.
Leptoperlidae Tillyard, 1921, *Canad. Ent.* **53:** 36; 1921, *Trans. Roy. Soc. S. Aust.* **45:** 270–273; 1923, *Trans. N. Zeal. Inst.* **54:** 202–203; 1926, *Ins. Aust. & N.Z.*: 119.

Tillyard has adopted for this family the name *Leptoperlidae*, but the reasons which he has set out in its support are, unfortunately, based upon a misunderstanding of an early paper by Newman. Tillyard (1921) writes: 'This family was first recognised as a distinct group by Newman in 1839, and has been raised to tribal rank by Banks under the name Leptoperlini, these authors not considering the whole of the Perlaria to be entitled to more than family rank. Now that the ordinal rank of the Perlaria is well established, the various tribes of Banks take family rank.'

In the first place, Newman merely erected a new genus, *Leptoperla*, with one species, *beroë*, and his introduction makes it clear that it was a genus of the family Perlidae. No mention is made that it belonged to a 'distinct group'. Secondly, Newman did not consider the whole of the Plecoptera to belong to one family. He heads his paper 'Class—NEUROPTERA. Natural Order—PERLITES. Family—PERLIDAE', and in his first paragraph he states that he uses the family Perlidae in a restricted sense, 'including only those genera which are furnished with caudal setae: Leach and Stephens incorporate with them the ecaudate Nemourae'. Thus it is evident that he recognized at least two families in what are now called Plecoptera.

The first worker to give family rank to this section of the Plecoptera was Enderlein, who in 1909 proposed the name Gripopterygidae; his family was a rather composite one, including the genera *Paragripopteryx* Enderlein, *Gripopteryx* Pictet, *Eusthenia* Gray, *Stenoperla* McLachlan, *Antarctoperla* Enderlein, *Notoperla* Enderlein, and *Paranotoperla* Enderlein, but omitting *Leptoperla* Newman. In 1913, under the tribal name Leptoperlini (sub-family Pteronarcinae), Banks groups *Austroperla* Needham, *Gripopteryx* Pictet, *Leptoperla* Newman, *Notoperla* Enderlein, *Aucklandobius* Enderlein, *Antarctoperla* Enderlein, and *Paranotoperla* Enderlein. Tillyard in 1921 raised Bank's tribe to family status and at the same time separated off *Austroperla* to form a distinct family.

Leptoperla Newman undeniably belongs to the same family as *Gripopteryx* Pictet, *Paranotoperla* Enderlein being actually a synonym of *Leptoperla*, and thus the name Leptoperlidae must give place to Gripopterygidae on grounds of priority.

Diagnosis of family

Fore wing with Sc terminating at from one-half to two-thirds of the wing length from the base, thus leaving a long pterostigmatic area, with or without cross-veins. Cross-veins, more or less numerous, are present in the distal half of the wing, and there is no transverse cord. Three anal veins present, first long, second and third shorter and fused at their bases. On posterior margin, between the terminations of

Cu1 and Cu2, the marginal fringe of hairs is modified into a row of hooked hairs, probably a form of wing-coupling. I have not seen this structure in any other family of Plecoptera, nor have I seen any previous record of it. In the hind wing, M3+4 is always fused with Cu1 shortly after it separates from M1+2; it may remain thus fused with Cu1 to the margin of the wing, or it may separate again, thus appearing like a fork of Cu1. Anal fan always forming an angle with the hind margin of the wing, and containing only six simple veins, including 1A; it is generally without cross-veins.

The nymphs may be readily distinguished by the tuft or rosette of filiform anal gills, whitish, pinkish, or pale mauve in colour. According to Tillyard, these nymphs are sluggish in habits, being found clinging to rocks in the swifter parts of fast-running streams. In the more mature nymphs the developing wing pads show the main venation of the adults quite clearly, and by this means it has been possible to recognize the nymphs of the three genera *Trinotoperla*, *Dinotoperla*, and *Leptoperla*.

KEY TO GENERA OF GRIPOPTERYGIDAE OF AUSTRALIA, TASMANIA, NEW ZEALAND, AND AUCKLAND ISLANDS

1. Rs forked in both pairs of wings 2
   Rs simple in both pairs of wings 5
2. Cu1 in fore wing forked 3
   Cu1 in fore wing simple 4
3. A series of cross-veins between Cu2 and 1A in fore wing
   EUNOTOPERLA Tillyard, p. 47
   Not more than one cross-vein in this area . . TRINOTOPERLA Tillyard, p. 75
4. Fork of Rs long . . . . . . MEGALEPTOPERLA Tillyard
   Fork of Rs terminal . . . . . . ZELANDOBIUS Tillyard
5. M3+4 and Cu1 in hind wing separate at base and apex, fused in middle of wing
   DINOTOPERLA Tillyard, p. 62
   M3+4 and Cu1 separate at base of hind wing, fused from centre of wing to margin 6
6. Generally only one cross-vein between Cu1 and Cu2 in hind wing
   LEPTOPERLA Newman, p. 48
   More than two or three cross-veins in this area 7
7. A series of cross-veins in the pterostigma in both wings
   ZELANDOPERLA Tillyard
   No cross-veins in the pterostigma 8
8. Fore wings shorter than the hind wings . AUCKLANDOBIUS Enderlein
   Fore wings longer than hind wings . . . NESOPERLA Tillyard

EUNOTOPERLA Tillyard

Eunotoperla Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48:** 194.
Type species: *E. kershawi* Tillyard, 1924 (fixed by Tillyard, 1924).

This genus is so far not represented in the British Museum (Nat. Hist.) and I am therefore quoting Tillyard's descriptions.

'Fore wing with Rs distally forked or three-branched, M forked from near middle of wing, Cu1 three-branched, or more rarely, simply forked; a thickened cross-vein between 1A and 2A; cells between M and Cu partially double; cubito-anal space with cross-veins. Hind wing with Rs terminally forked or simple, M forked, Cu1 forked or simple; apex well rounded; anal fan moderately wide, with a few weak cross-veins developed in the region of 1A and 2A. Cerci short. Size of species large, expanding 50 mm. or more.

'This genus shows an approach to the Eustheniidae in the beginning of the development of cross-veins on the anal fan, and is in other respects somewhat similar to the genus *Stenoperla* of that family; it can be at once distinguished by the marked angle between the border of the anal fan and the rest of the hind wing, this angle being entirely absent in the Eustheniidae.'

Distribution: AUSTRALIA, Victoria.

Eunotoperla kershawi Tillyard

FIG. 1

Eunotoperla kershawi Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48:** 195, fig. 2; 1926, *Ins. Aust. & N.Z.*: 119, pl. 10, fig. 16.

'♂. Length of body (abdomen much shrunken): 11 mm., of fore wing 25 mm., antennae 16 mm., cerci 4 mm. Body, legs, and antennae blackish, with front border of pronotum brownish. Wings dull brownish with dark brown venation; cross-veins nearly all enclosed in pale transparent whitish areas; thickened cross-vein between 1A and 2A of fore wing dark brown; supra-anal plate with a copulatory process in the form of a slender, downcurved spine; paraprocts with a pair of shorter, upcurved spines.

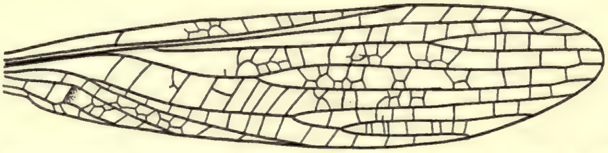


FIG. 1. *Eunotoperla kershawi* Tillyard. Right fore wing (after Tillyard).

'♀. Length of body (not shrunken): 25 mm., fore wing 30 mm.; differs from male in having abdomen and pronotum brown, wings dark brown, the hind wings somewhat fuscous.

'Types: Holotype male and allotype female (Warburton, Victoria, 12.94) in National Museum, Melbourne; paratype male, from same locality, in Cawthron Institute collection, Nelson, N.Z., also a male from Thorpdale, Gippsland.'

LEPTOPERLA Newman

Leptoperla Newman, 1839, *Mag. Nat. Hist.* **3** (n.s.): 89.

Type species: *L. beroë* Newman 1839 (only species included by Newman).

Walker, 1852, *Cat. Ins. B.M.* **1:** 169; Banks, 1913, *Trans. Amer. Ent. Soc.* **39:** 203; Tillyard, 1921, *Canad. Ent.* **53:** 42, fig. 4*a*; 1921, *Trans. Roy. Soc. S. Aust.* **45:** 273.

Paranotoperla Enderlein, 1909, *Zool. Anz.* **34:** 393, 416 (**Syn. nov.**)

Type species: *P. australica* Enderlein (fixed by Enderlein, 1909).
Enderlein, 1909, *Dtsch. Ent. Z.* **1909:** 634, fig. 2; Tillyard, 1921, *Trans. Roy. Soc. S. Aust.* **45:** 273.

Newman's description of the genus is very brief. 'Proalarum nervurae apicales 6, nervuris transversis numerosis intersectae: antennae setaeque caudales elongatae; pedes elongati.'

The type of *L. beroë* is gummed on a card and the wings are somewhat crumpled. Tillyard examined the specimen in 1920 and gave an extended generic diagnosis in the *Canadian Entomologist.* For some reason he did not completely spread out the left fore wing when he softened it for examination, and consequently the fact that the right fore wing (with Rs forked almost to its origin) was abnormal escaped his notice. Through the courtesy of Professor G. Hale Carpenter I have been able to study, amongst other Australian material, the type of *L. beroë.* Included in this material was an example resembling *beroë,* but without the forked Rs in the fore wing. This aroused my suspicions and I removed and spread out the left fore wing of the type. In this, Rs was simple and the whole venation was of the pattern of *Paranotoperla* Enderlein (Fig. 2 *b*). Genitalia and cerci also agree with that genus, and I have no hesitation in placing Enderlein's genus in the synonymy of *Leptoperla.*

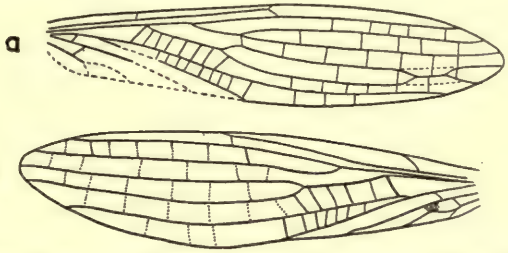


FIG. 2. *Leptoperla beroë* Newman, ♂ type. *a*, right fore wing (after Tillyard, showing aberrant fork of Rs); *b*, left fore wing (original).

The following is my revised diagnosis of the genus. Fore wing with Rs simple, M forked near the middle of the wing, Cu1 simple; cubito-anal space with only one cross-vein: a thickened cross-vein between 1A and 2A. Hind wing with Rs simple, Rs and M generally separating close to the base of the wing; in *L. rugosa, L. reticulata,* and *L. nigrifrons* they remain fused for a much greater distance; posterior branch of M fused with Cu1 from near the fork of M to the wing margin. Generally only one cross-vein between the branches of Cu. Anal fan rather narrow. Cerci long.

Distribution: Australia, Tasmania, Fiji Islands.

Leptoperla beroë Newman

FIGS. 2, 3

Leptoperla beroë Newman, 1839, *Mag. Nat. Hist.* **3** (n.s.): 89–90; Walker, 1852, *Cat. Neur. Ins. B.M.* **1:** 169; Banks, 1913, *Trans. Amer. Ent. Soc.* **39:** 203; Tillyard, 1921, *Canad. Ent.* **53:** 42, fig. 4*a*; 1921, *Trans. Roy. Soc. S. Aust.* **45:** 273; 1926, *Ins. Aust. & N.Z.*: 119.

Newman's description (given below) is good, but owing to the aberrant fore wing, his statement that there are *six* parallel veins in the fore wing should be read as *five.*

'Sp. 1. *Leptoperla Beroë.* Fusca, alae opacae, fuscae, versus apicem maculis albidis notatae; pro- et mesopedes fusci, tibiis medio testaceis: metafemora testacea, apice fusca. (Corp. long. ·3 unc. ant. ·475 unc. set. caud. ·475 unc. alar. dilat. ·9 unc.)

'This is a slender and very elegant insect, it differs generically from *Isogenus* and *Perla* in the neuration of the fore wings, the exterior portion of which is occupied by six strong parallel longitudinal nervures; of these the fourth is furcate at the extremity and the fifth unites with the fourth just before its furcation;[1] these longitudinal nervures are intersected by several very delicate transverse nervures: the *antennae* and caudal *setae* are very slender, and much longer than the body of the insect; the terminal segment of the *abdomen* is furnished below with two leaf-like processes, which curve upwards, passing between the caudal *setae* and terminating in acute points: the legs are very long and slender: the insect is of a dark brown colour, the wings being opaque, dark brown, and the exterior portion of the fore wings regularly spotted with dirty white; the hind wings are immaculate; the *pro-* and *mesofemora* having a bright testaceous ring; the *metafemora* are testaceous, with the apex only dark brown, the *tibiae* are rather paler, and the tarsi nearly black.

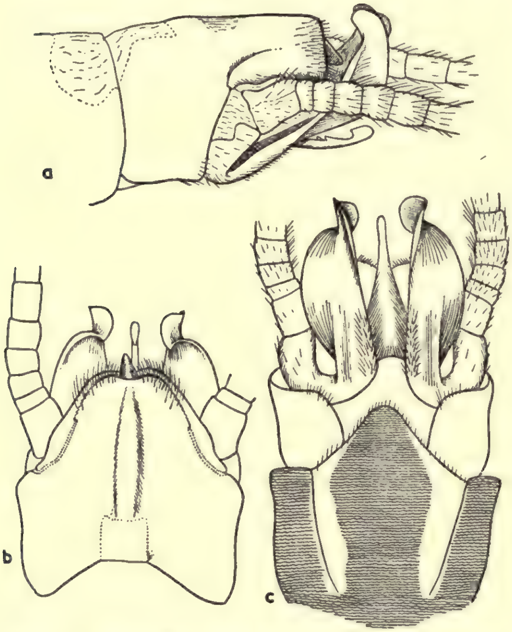


FIG. 3. *Leptoperla beroë* Newman, ♂. Genitalia, *a*, lateral; *b*, dorsal; *c*, ventral.

'Inhabits Van Diemens Land. There is a single specimen in the cabinet of the Rev. F. W. Hope.' (Now in the Hope Department, University Museum, Oxford.)

To this description may be added the following account of the male genitalia. Apical tergites pigmented at bases and sides, sternites with a pair of basal spots. Tenth tergite large, narrowed apically, apical margin truncate from the side and carrying a short triangular process. There is a low median dorsal carina, and at the centre of the basal margin is a small quadrate, membranous area. Supra-anal lobe slender, not projecting much beyond the margin of the tergite. From the side there is a dorsal excision before the apex. giving the appearance of a crochet-hook, and several acute dorsal teeth. Sub-anal plates large, broad, leaf-like, curving upwards, with somewhat twisted apices; lower basal margins heavily fringed with hairs. Cerci long, at least thirty-seven-segmented. Subgenital plate triangularly produced, pigmented at its centre, giving the impression of being narrower.

The above genitalic description has been made from a second example in the Hope Department, University Museum, Oxford.

---

[1] Tillyard has shown this to be an aberration; in the left fore wing all these veins run parallel.

Leptoperla australica (Enderlein)

FIG. 4

Paranotoperla australica Enderlein, 1909, *Zool. Anz.* **34:** 416; 1909, *Dtsch. Ent. Z.* **1909:** 684; 1912, *Fauna SW. Aust.*: 60; Tillyard, 1921, *Trans. Roy. Soc. S. Aust.* **45:** 270; ? Šámal, 1921, *Časopis*, **18:** 66–70.

Šámal's reference to the occurrence of this species in Tasmania is probably based on a mis-determination and may possibly refer to *L. beroë*. I have not seen any examples of *L. australica* from the island and I believe it to be restricted to west and south-west Australia.

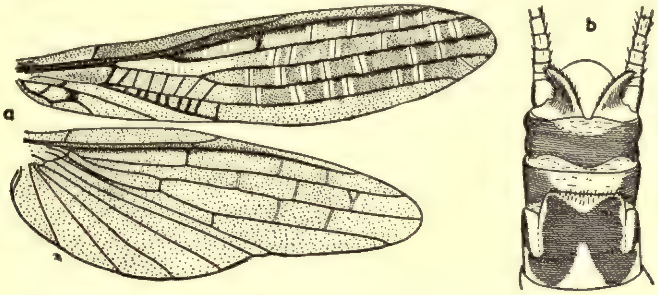


FIG. 4. *Leptoperla australica* (Enderlein) ♀. *a*, wings; *b*, genitalia, ventral.

Head brownish-yellow, darker above. Eyes black. Thorax brown, almost rectangular, somewhat longer than broad, front and hind margins straight, lateral margins straight and diverging slightly from front to back; no impressed median line, but with anterior and posterior transverse furrows; anterior angles rounded. Abdomen light brown, in the female paler beneath, subgenital plate brown. Cerci dark brown, longer than abdomen, about thirty segments. Legs brownish-yellow, marked with dark brown at the knees, apices of tibiae, and on the tarsi. Wings light brown, with brown venation, distal cross-veins pale and enclosed in whitish spaces; generally without cross-veins between Cu1 and wing margin in fore wing.

I have seen no males; Enderlein says that the last tergite in this sex is triangular. His description of the subgenital plate apparently refers to the female.

♀. Subgenital plate large, quadrate, angles rounded, projecting somewhat beyond the segment, brown, with pale triangular excised areas, a broad shallow area at apex and a narrow deep one at base. Sub-anal plates triangular, apices curving outward.

Length of fore wing ♂ 9·5–10 mm., ♀ 7·5–9·5 mm.

Length of hind wing ♂ ?, ♀ 6·5–8·5 mm.

SW. AUSTRALIA: Lunenberg, 22.ix.1905, Serpentine, 23–25.ix.1905, Harvey, 27.vii.1905 (Hamburg SW. Australia Expedition). WEST AUSTRALIA: Bolgonup, 1.x.1922 (R. J. Tillyard).

Type in Stettin Museum.

Leptoperla tasmanica sp.n.

FIG. 5

(In fluid.) Head, thorax, and three terminal segments of abdomen brown, shining, segments one to seven whitish. Antennae longer than fore wing. Pronotum trapezoidal, anterior margin two-thirds as wide as posterior, a little shorter than width at base. Legs brownish, distinctly banded with dark brown towards apex of femur and base of tibia, apex of tibia and tarsus clouded with darker brown. Wings elongate, fore wing medium fuscous, with pale markings; all cross-veins, and to a lesser degree also the longitudinal veins in the apical half margined with whitish, so that each cellule is dark, surrounded by a pale line. In female, cross-veins are more numerous, and main veins are not bordered with whitish, only the cross-veins. In the basal half of the wing it is the cells which are pale, bordered with fuscous. Veins pale fuscous, except apical cross-veins which are whitish (pale purplish in dried examples). Hind wing uniform pale fuscous, with darker veins.

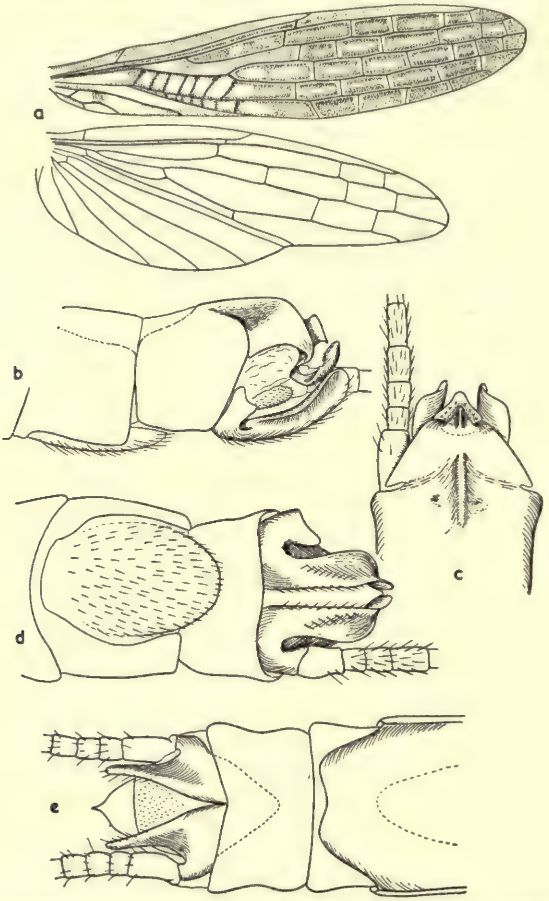


FIG. 5. *Leptoperla tasmanica* sp.n. *a*, wings, ♂; *b–d*, genitalia ♂, left cercus omitted, *b*, lateral, *c*, dorsal, *d*, ventral; *e*, genitalia ♀, ventral.

♂. Ninth tergite with a large unpigmented area on dorsum, extending almost to base. Tenth tergite with a strong longitudinal ridge, and on each side of it a small rounded depression, base of segment unpigmented; apical margin triangularly produced, apex truncate, bent down from the side, and carrying a ridged projection, triangular from above, quadrate from the side, its lower apical angle acute. Supra-anal lobe broad, triangular, curving upward, its upper surface set with teeth. Cerci brownish, at least as long as abdomen (incomplete in type), more than twenty-three-segmented, basal segment pale. Sub-anal plates blunt, curving upward, upper margin curved over outward. Above them is a small setose lobe. Subgenital plate ovate, projecting about a quarter of its length beyond the sternite, separated from the segment by an unpigmented band.

♀. Dorsum of eighth and ninth segments membranous, tenth pigmented, triangularly produced and deflexed, terminating in a slender blackened spine; dorsally there are two small rounded pits similar to those in the male. Subgenital plate broad at base, narrowed to half its width at apex, which is shallowly emarginate or sometimes merely truncate. It extends nearly to the apex of ninth sternite, and is brownish, with a narrow triangular whitish area, the base of the triangle adjoining the basal margin of the plate. Anal plates triangular, apices produced in flattened fingers. Cerci brownish, about twice as long as abdomen.

Length of fore wing ♂ 12 mm., ♀ 12 mm.

Length of hind wing ♂ 10 mm., ♀ 10 mm.

TASMANIA: Gouldt County, 10.ii.1933, 1 ♂; Penstock Lagoon, 27–29.i.1933, 3 ♀ (R. J. Tillyard); Great Lake, ii.1934, 2 ♀ (Critchley Parker).

Type ♂ (from Gouldt County) and a paratype female from Penstock Lagoon are microscope preparations, the two females from Great Lake are pinned and the remaining two females are in 2 per cent. formaldehyde solution.

This species has paler wings than *L. australica* (Enderlein), and the presence of cross-veins between Cu1 and the margin in the fore wing will help to separate it from that species.

Leptoperla exigua sp.n.

FIG. 6

(In fluid.) Head and thorax brownish, abdomen paler, particularly beneath. Antennae long, brownish. Pronotum quadrate, about one-fifth broader than long, anterior angles rounded, anterior and posterior transverse furrows shallow. Legs yellowish-brown, femora with a darker ring just before apex, which is pale, base of tibiae also darker. Fore wing with apical cross-veins whitish, outer ones arranged in an almost straight row across the wing. In hind wing Rs and M separate close to base.

♂. Tenth tergite with its apical margin quadrately produced and deflexed; from a rounded whitish area arises a slender upcurved process, somewhat ridged dorsally. Supra-anal lobe long and slender, particularly in apical half, apex hooked downward. Cerci pale brownish, longer than abdomen, about thirty-two-segmented. Sub-anal plates upcurved, fitting closely on either side of the supra-anal lobe, apices dilated and terminating in an acute spine. Subgenital plate rather broad-oval, a small unpigmented area at its apex giving the appearance of being excised.

♀. Sides of the eighth and ninth tergites pigmented, dorsum membranous, tenth pigmented and triangularly produced. Sub-genital plate large, dark brown, apex shallowly excised, sides narrowly unpigmented, giving the appearance of a constriction before the apex. Basally on each side is a shallow rounded depression. Sub-anal plates triangular, outer margins with a deep rounded excision. Cerci pale brownish, about as long as the abdomen.

Length of fore wing, ♂ 6·5 mm., ♀ 7 mm.

Length of hind wing, ♂ 5·5 mm., ♀ 6 mm.

W. Australia: Kelmscott, 22.ix.1932, 2 ♂, 10 ♀, Bolgonup, 1.x.1932, 4 ♂, 2 ♀, (R. J. Tillyard); Chidlow, near Perth, 14.ix.1923, 3 ♂, 1 ♀, Mundaring, near Perth, 15.ix.1923, 1 ♀, (G. A. K. Marshall). Tasmania: 1 ♂ (J. W. Evans).

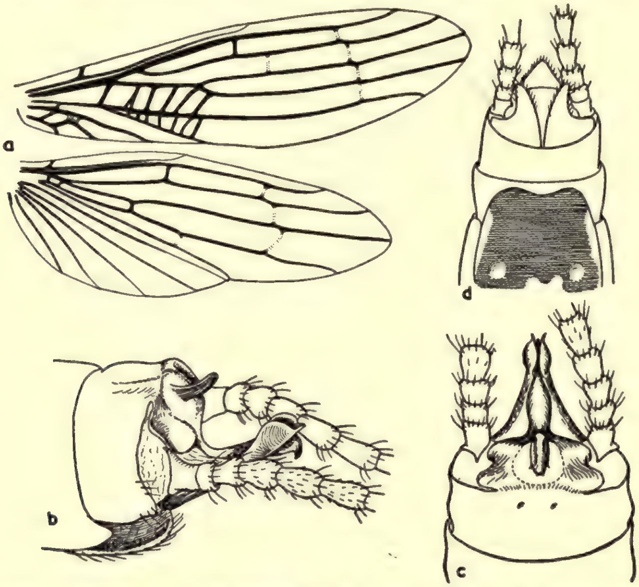


Fig. 6. *Leptoperla exigua* sp.n. *a*, wings ♂; *b–c*, genitalia ♂, *b*, dorso-lateral, *c*, dorsal; *d*, genitalia ♀, ventral.

Type male, paratype female from Kelmscott, paratype male from Chidlow as microscope preparations, others from Kelmscott and Bolgonup in 2 per cent. formaldehyde solution, remainder pinned.

In the single male from Tasmania the arrangement of cross-veins is not quite the same, but such differences as there are in genitalia are so slight that, in the absence of more material it is proposed to consider it as *L. exigua*.

Leptoperla varia sp.n.

Fig. 7

(In fluid.) Head, thorax, and apex of abdomen brownish, remainder of abdomen whitish. Antennae long, brownish. Pronotum a little longer than broad, slightly narrowed anteriorly, with two broad transverse furrows, median line not well marked. Legs yellowish-brown, knees strongly banded with dark brown, apices of tibiae and tarsal segments brownish. Wings pale fuscous with darker venation. Fore wing largely pale at base, apical half with cross-veins pale, bordered with whitish, and with numerous pale speckles. Hind wing uniform pale fuscous, except costal area and apical cross-veins, which are whitish. Rs and M separating close to base.

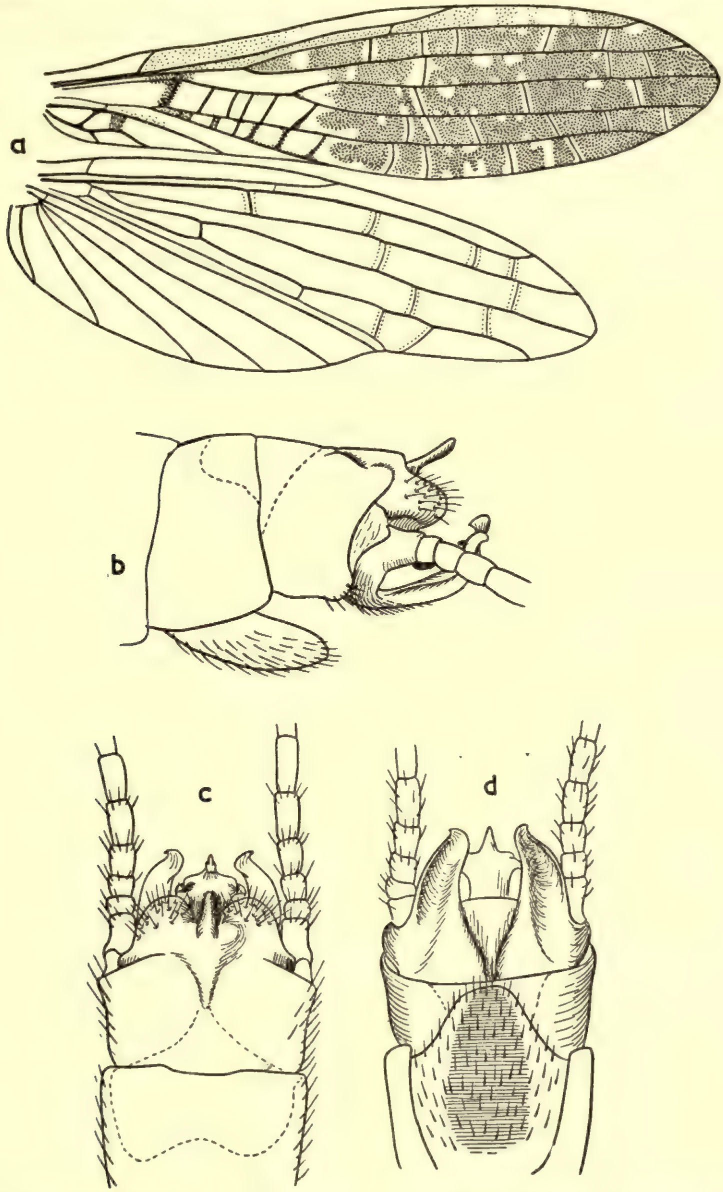


Fig. 7. *Leptoperla varia* sp.n. ♂. *a*, wings; genitalia, *b*, lateral, *c*, dorsal, *d*, ventral.

♂. Ninth tergite membranous dorsally, except at base. Tenth with a short median ridge, apical margin produced in two rounded lobes. The base of the excision between them is unpigmented and membranous, and from it arises a slender process, slightly dilated apically from side. Supra-anal lobe moderately broad at base, its apex triangularly dilated and hooked, the two side angles each armed with a pair of hooks. Cerci brownish, at least as long as abdomen, about forty-five-segmented. Sub-anal plates broad at base, upcurved, hollowed on their lower surfaces, rather transparent, apices slightly hooked. Subgenital plate triangularly produced, apex rounded, a pigmented area down its centre making it appear narrower than it really is; it extends almost to the apex of the tenth sternite.

♀ (in the form of a microscope preparation from the Tillyard collection). Too distorted by pressure in mounting for description.

Length of fore wing ♂ 8 mm., ♀ 9·75 mm.

Length of hind wing ♂ 7 mm., ♀ 8 mm.

TASMANIA: Lake St. Clair, 6.ii.1933, 1 ♂, Scottsdale, 2.xi.1927, 1 ♂, 23.i.1933, 1 ♂, 1 ♀ (R. J. Tillyard).

Type male, Lake St. Clair, male and female paratypes in form of microscope preparations, one male paratype in 2 per cent. formaldehyde solution.

The speckled wings and bilobed tenth tergite of the male separate this species from any of the genus known to me.

Leptoperla rugosa sp.n.

FIG. 8

(In fluid.) Head, thorax, and two terminal segments of abdomen brown, remainder of abdomen whitish, with small transverse brown sclerites, four on each tergite, three on each sternite, two anterior and a larger posterior one. Antennae slightly longer than fore wing, apices of segments more dilated than in *tasmanica*. Pronotum one-third broader than long, slightly narrowed anteriorly, posterior angles square, anterior rounded. Surface finely rugose or tuberculate, with deep anterior and posterior transverse furrows, linked by a fine median impressed line. Legs brownish, knees a little darker.

Wings moderately elongate, pale to medium fuscous, with darker veins. Both pairs generally with a narrow pale streak along apical half of costal area. Fore wing with three cross-veins below subcosta and four cross-veins in steps near the apex of the wing, one cross-vein between Cu1 and margin. In hind wing, Rs and M separate at some distance from base, about half-way to fork of M.

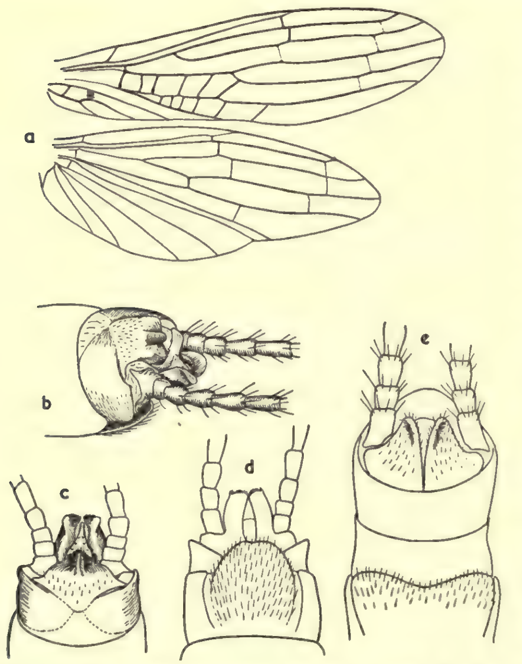


FIG. 8. *Leptoperla rugosa* sp.n. *a*, wings ♂; *b–d*, genitalia ♂, *b*, dorso-lateral, *c*, dorsal, *d*, ventral; *e*, genitalia ♀, ventral.

♂. Apical margin of tenth tergite deflexed, and bearing a short process, finger-like from the side, keeled dorsally. Supra-anal lobe upcurved, of medium width at base, tapering to a slender apex from above, upper lateral margins set with triangular teeth, a sinuous hooked projection on the ventral surface directed basally. Cerci brownish, longer than the abdomen, twenty-seven or more segments. Sub-anal plates broad, upcurving, apices truncate and setose, upper angles curving over outwards. Subgenital plate ovate, apex slightly flattened, sometimes slightly excised, extending beyond the bases of the sub-anal plates.

♀. Sides of segments eight and nine brownish, dorsum membranous; tenth tergite brownish, margin produced and rounded. Subgenital plate lightly chitinized, about the width of the segment and scarcely produced, its apex shallowly excised. Sub-anal plates triangular, apices rounded, not produced in long blades. Cerci brownish, about twice as long as the abdomen.

Length of fore wing, ♂ 7 mm., ♀ 7·75 mm.

Length of hind wing, ♂ 6 mm., ♀ 6·5 mm.

AUSTRALIA: Federal Capital Territory, Lee's Springs, xi.1932, 6 ♂, 1 ♀, Murrumbidgee River, i.1922, 1 ♂ (R. J. Tillyard); New South Wales, Bathurst, 2,300 ft., 10.xi.1884, 1 ♂ (from McLachlan collection).

Type male and one paratype male (from Lee's Springs) as microscope preparations, Bathurst male pinned, remainder in 2 per cent. formaldehyde solution.

The arrangement of the outer cross-veins of the fore wing in steps, anterior cross-veins nearer apex, seems reasonably constant, as does the position of separation of Rs and M in hind wing. The type and female paratype are rather paler than the others, probably due to the degree of maturity.

Leptoperla reticulata sp.n.

FIG. 9

♂ unknown.

♀ (in fluid). Head yellowish-brown, marked with dark brown between the ocelli and on the occiput. Antennae brown, about 7 mm. long, a little shorter than the anterior wing. Pronotum dark fuscous, a little broader than long, narrowed anteriorly; a narrow, impressed, piceous median line linking similar anterior and posterior transverse lines. The latter do not extend more than half the width of the pronotum. Meso- and metanota shining piceous brown. Legs yellowish-brown, marked with dark brown at apices of femora, extending along posterior surface, bases and apices of tibiae and on the tarsi. Abdomen whitish above, except the tenth and sides of seventh to ninth tergites, which are fuscous, and the pale fuscous sternites of the first seven segments. Subgenital plate and centre of ninth sternite brown. Sub-anal plates light fuscous, margined exteriorly with dark brown. Wings rather short, pale greyish, with fuscous venation; membrane slightly clouded with brownish in costal area, around the pterostigma and bordering some of the cross-veins. In the fore wing, the most noticeable feature is the arrangement of the cross-veins in the apical half, where they tend to form an irregular network between the main veins. Cross-veins in apical half of hind wing normal.

Subgenital plate broad, only slightly produced; margin with a shallow excision, strongly pigmented. Ninth sternite with a small dark brown lobe at its centre, separated from the remainder of the sternite by notches in the apical margin. Sub-anal plates broad, apices stout, blunt and divergent. Cerci about 5 mm. long, twenty-six-segmented, yellowish-brown, moniliform at base, becoming filiform. Tenth tergite triangularly produced to a small rounded apex.

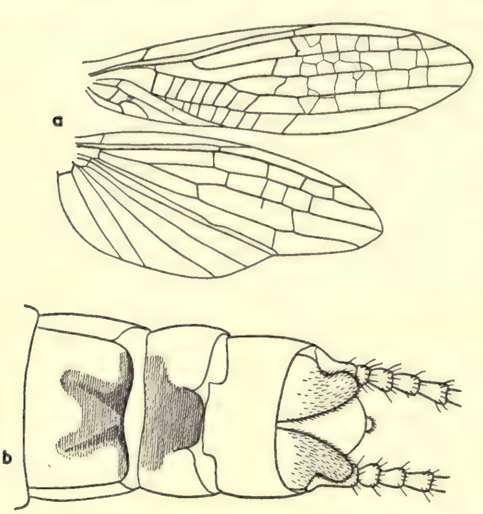


FIG. 9. *Leptoperla reticulata* sp.n. ♀. *a*, wings, *b*, genitalia, ventral.

Length of fore wing, 8·5 mm., of hind wing, 7·25 mm.

AUSTRALIA: New South Wales, Mt. Kosciusko, Spencer's Creek, xii.1932, 1 ♀ (R. J. Tillyard).

Type in form of microscope preparation.

This species should be easily separable from other described species by the irregular reticulation of the fore wing, and by the lobe of the ninth sternite.

Leptoperla nigrifrons sp.n.

FIG. 10

♂ (in fluid). Head dark brown, pitchy-black between epicranial suture and labrum; antennae brown, basal segment blackish above. Pronotum brown, with blackish rugosities, median line, anterior and posterior furrows blackish; quadrate, parallel-sided, about as long as broad, anterior margin slightly convex, anterior angles rounded. Meso- and metanota brown. Legs brown, femora blackish. Wings hyaline, with considerable pale brownish suffusion as in Fig. 10; venation brownish, apical cross-veins rather weak. In posterior wing the stalk of Rs+M is rather long, there are two or three cross-veins between Cu1 and Cu2, and the angle between the posterior margin and the anal fan is rather abrupt. Abdomen and cerci brownish. Ninth tergite somewhat excised and membranous at the centre of its apical margin. Ninth sternite moderately produced in a parallel-sided subgenital plate, whose apex in ventral view is rounded, with a shallow median excision. Tenth tergite small, dorsally almost divided into two lobes by excisions of the apical and basal margins. Supra-anal lobe broad at base, in dorsal view with a finger-like process arising from an elevated trapezoidal base; below this the lobe is bent downward and tailward. About midway on the upper surface is a small basally-directed hook, and the lobe terminates in a downturned hook. Cerci long, slender, with more than thirty segments (incomplete), which become progressively longer and more slender towards the apex. The second segment is obliquely truncate, causing the cerci to be angled in dorsal view. Sub-anal plates upcurved in side view, gradually dilating to a truncate apex, with a pointed upper angle. In ventral view they are slender, with out-turned apices.

Length of fore wing, 8 mm.

TASMANIA (J. W. Evans), 2 ♂.

Type male in form of microscope preparation, paratype in 2 per cent. formaldehyde solution.

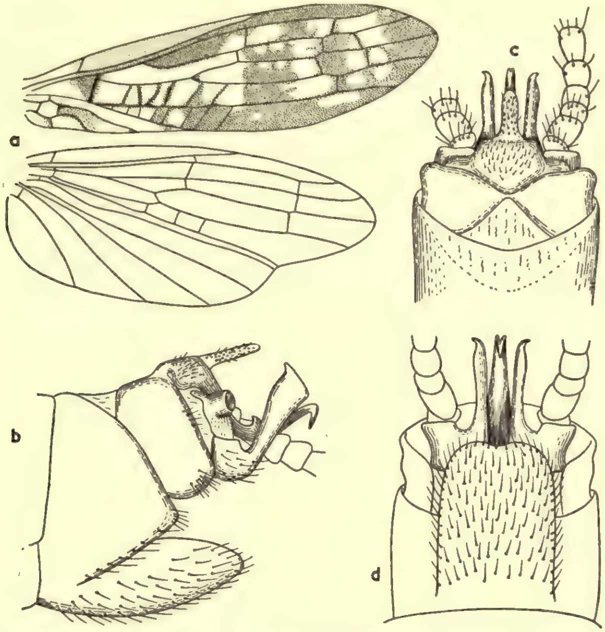


FIG. 10. *Leptoperla nigrifrons* sp.n. ♂. *a*, wings, showing pattern of fore wing; *b*, genitalia, lateral (left cercus omitted), *c*, genitalia, dorsal, *d*, the same, ventral.

The venation of the posterior wing suggests that this species be grouped with *L. rugosa* and *L. reticulata*, but it may be separated from them by the pattern of the fore wing and the shape of the anal fan.

Leptoperla sp. No. 1

FIGS. 11–13

Nymph (? about half-grown). General colour yellowish-brown, with obscure, slightly darker markings; of rather slender build (about 7 mm. long), legs rather stout. Body sparsely clothed with short hairs, and in some areas very short, stout spinules. Head rather wider than the pronotum, brownish, smooth, developing ocelli visible as black spots beneath the integument. Antennae incomplete, fairly stout, tapering towards apex: first segment large, second smaller, but still larger than any of the next few succeeding ones; a few scattered setae, but no dorsal fringe.

Labrum about twice as broad as long, anterior angles rounded. Labium with glossae a little shorter than paraglossae, about the same width, with an apical tuft of setae; excision between glossae very narrow. Paraglossae pointed, inner margins straight, outer rounded. Labial palpus three-segmented, terminal segment large, ovate, as long as first and second together. Maxilla well developed: lacinia with three or four blunt plate-like teeth at its apex and near them, on its inner margin, a row of strong acute setae. Galea about as long as lacinia, tapering to a setose apex. Palpus five-segmented, first, second, and fourth short, second half as long again as the first, third twice as long as the first, fourth equal to the second, and fifth a little longer than first and second. Mandibles strongly chitinized, with a number of acute teeth near apex.

Pronotum about as long as broad, slightly narrowed in front, angles rounded, anterior and posterior margins both somewhat convex; median impressed line about half as long as pronotum, anterior and posterior impressed lines present, angled towards each other at their centres. Surface of pronotum smooth. Wing pads small, anterior elongate, posterior triangular; venation typical of the genus. Mesonotum with an irregular row of small spinules along the anterior margin and over base of wing pad. Posterior margins of meso- and metanota produced backward, plate-like, a narrow incision separating their lateral angles from the wing pads.

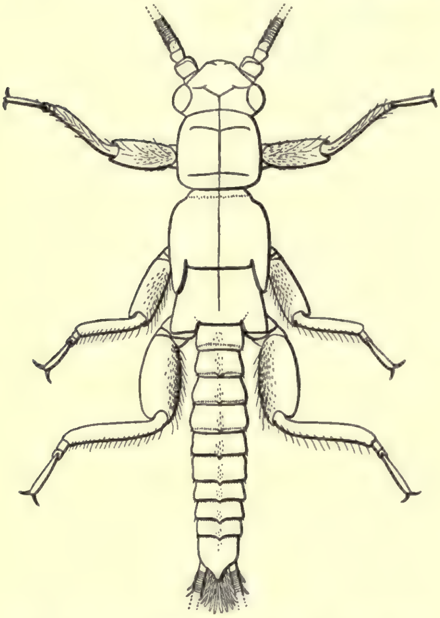


FIG. 11. *Leptoperla* sp. No. 1. Nymph.

Legs short and strong, yellowish-brown, femora dorsally with short spinules and setae, rather deep; tibiae a little longer than femora, with short acute spinules on inner surfaces, and a sparse row of fine setae exteriorly. First tarsal segment short, second very short, third about three times as long as first.

Abdomen cylindrical, tergites two to nine elevated along the median line, apical margin of each produced in a short spur. This elevated area and the apical margin bears short spinules as well as hairs, sternites bearing hairs only. Margin of tenth tergite triangularly produced. Anal gills dull whitish. Cerci incomplete. Sub-anal plates broad, spatulate.

TASMANIA: Scottsdale, Cuckoo Falls Creek, 31.vii.1931 (R. J. Tillyard). Five examples, probably all males; it is possible that these nymphs may belong to the species *L. varia* Kimmins, which occurs in this locality. The somewhat irregular arrangement of the cross-veins in the nymphal fore wing suggests this, but further confirmation is needed.

Leptoperla sp. No. 2

FIGS. 12–13

Full-grown male nymph. General colour fuscous. of slender build, with rather short legs: length about 6 mm. Body smooth, sparsely clothed with short setae, whose apices are slender and curled. Head about as wide as pronotum, antennae incomplete, moderately stout, tapering.

Labrum about twice as broad as long, anterior angles rounded. Labium with glossae a little shorter and narrower than paraglossae, with an apical tuft of setae. Paraglossae less pointed than in sp. No. 1. Labial palpus rather stouter than in sp. No. 1; maxillae with palpus rather stouter, mandibles similar.

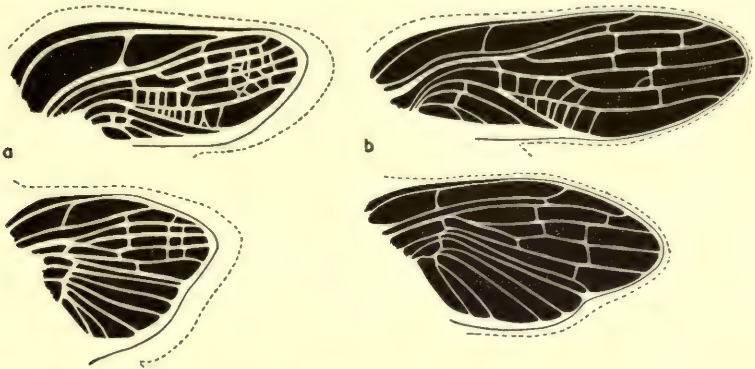


FIG. 12. *Leptoperla* spp. Nymphal venation. *a*, sp. No. 1; *b*, sp. No. 2.

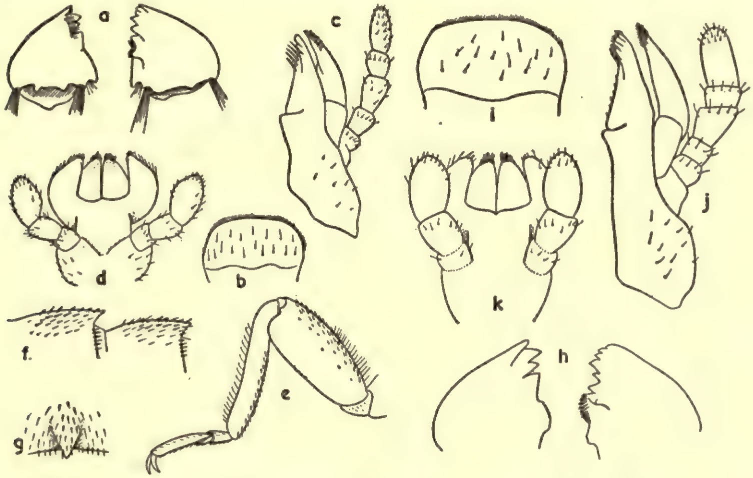


FIG. 13. *Leptoperla* spp. Nymphal structures. *a–g*, sp. No. 1; *h–k*, sp. No. 2. *a*, mandibles; *b*, labrum; *c*, maxilla; *d*, labium; *e*, leg; *f*, dorsal armature of abdominal tergites, lateral; *g*, the same, dorsal; *h*, mandibles; *i*, labrum; *j*, maxilla; *k*, labium.

Pronotum broader than long, somewhat narrowed anteriorly, angles rounded, margins straight. Strong median and transverse impressed lines, anterior shorter than posterior, both angled towards each other at their centres. Wing pads of medium size, anterior elongate, overlapping basal two-thirds of posterior; fuscous, with longitudinal veins slightly darker. Imaginal venation less distinct than in some species, few cross-veins in apical half of wings. No incision between anal angle of wings and nota.

Legs paler than body, similar to sp. No. 1, but with rather fewer short setae. Abdomen long, cylindrical, somewhat ridged along dorsum, apical margins not produced. Tenth tergite much elevated in a median dorsal ridge, terminating in an acute finger, projecting beyond the triangularly produced margin. Basal margin with a pair of acute triangular apodemes. Anal gills pale pinkish, cerci incomplete. Sub-anal plates about twice as long as broad, parallel-sided for most of their length, tapering near apex.

TASMANIA: Scottsdale, a number of male nymphs.

Smaller than sp. No. 1, rather more slender; pronotum is definitely broader in proportion to its length, and tenth tergite is more produced; sub-anal plates narrower.

DINOTOPERLA Tillyard

Dinotoperla Tillyard, 1921, *Canad. Ent.* **53:** 43, fig. 4*b*.
Type species: *Perla opposita* Walker, 1852 (fixed by Tillyard, 1921).
Tillyard, 1921, *Trans. Roy. Soc. S. Aust.* **45:** 270–273, figs. 2–3.

Fore wing with Rs simple, M forked from near the middle of wing, Cu1 forked; a thickened cross-vein between 1A and 2A; cubito-anal space with a basal cross-vein only. Hind wing with Rs simple; M and Rs separating some distance from base; M forked, posterior branch fused for a space with Cu1, separating again before the margin of the wing; generally only one cross-vein between the branches of cubitus. Anal fan rather narrow. Cerci shorter than abdomen.

Distribution: Australia, Tasmania.

Dinotoperla serricauda sp.n.

FIG. 14

Head, thorax, and apex of abdomen brown, segments one to eight of abdomen whitish. Eyes blackish, antennae brown, about as long as fore wing, basal segment enlarged. Pronotum almost rectangular, broader than long, slightly narrowed anteriorly. Legs brownish, slightly darker at the knees. Wings pale fuscous, with darker venation; in anterior, R, Rs, and most cross-veins broadly shaded with darker fuscous. Veins in hind wing not shaded.

♂. Apical margin of tenth tergite produced at its centre in a pale process, triangular and acute from the side; from above broad and pigmented at its base, tapering to a narrow, rounded apex, upper surface closely set with minute setae. Supra-anal lobe projecting beyond apex of tergite, slender and blade-like from above, apex abruptly hooked downwards. Cerci brownish, about 1¼ mm. long, eleven-segmented, tapering slightly, segments near base shorter than broad, slightly serrately produced on inner surfaces. Sub-anal plates scimitar-like, apices somewhat incurved; from beneath, they are seen to arise from broad bases and are contiguous for most of their length. Margin of ninth sternite produced in a parabolic subgenital plate about as long as its sternite, from side appearing as a stout, blunt finger.

♀. Wings more elongate. Subgenital plate of eighth sternite very short and broad, scarcely projecting beyond the margin. Sub-anal plates triangular, from beneath apices produced in slender fingers: near the upper basal angle is a small, rounded, whitish pit. Cerci less serrate than in male, twelve-segmented. Margin of tergite produced, rounded and bent down, whitish, with minute setae as in male.

Length of fore wing, ♂ 9·5 mm., ♀ 11 mm.

Length of hind wing, ♂ 8·5 mm., ♀ 9·5 mm.

TASMANIA: R. Ouse, 4.ii.1933, 4 ♂, 2 ♀ (R. J. Tillyard); Deloraine, 20.xii.1884, 1 ♀.

Type male (R. Ouse) in form of microscope preparation, 3 ♂, 2 ♀ paratypes in 2 per cent. formaldehyde solution, 1 ♀ paratype from Deloraine, pinned.

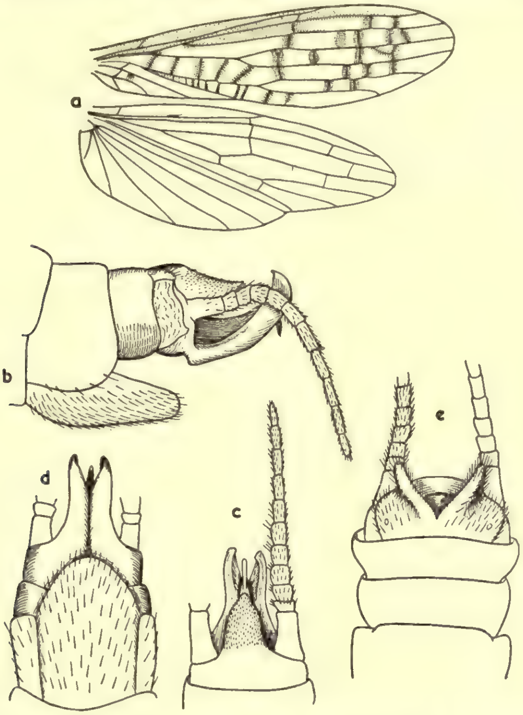


FIG. 14. *Dinotoperla serricauda* sp.n. *a*, wings ♂; *b–d*, genitalia ♂, *b*, lateral, *c*, dorsal, *d*, ventral; *e*, genitalia ♀, ventral.

Compared with *D. carpenteri* Tillyard, in fore wing the posterior margin between Cu2 and Cu1*b* is more bowed, and Cu1*b* is longer. In the hind wing, the anal fan is broader. Tillyard's figure does not permit of a useful comparison of the male genitalia.

Dinotoperla opposita (Walker)

FIG. 15

Perla (sg. *Chloroperla*) *opposita* Walker, 1852, *Cat. Neur. Ins. B.M.* **1:** 171.

Leptoperla opposita McLachlan, 1874, *Trans. N.Z. Inst.* **6** (Append.): xcii; Banks, 1913, *Trans. Amer. Ent. Soc.* **39:** 203.

Dinotoperla opposita Tillyard, 1921, *Canad. Ent.* **53:** 43; id., 1923, *Trans. N.Z. Inst.* **54:** 203.

Walker described the species as follows:

'100. PERLA OPPOSITA.

'Nigra, nitens, ferrugineo varia; caput antice testaceum, thorace vix latius; prothorace antice non latius, disco ruguloso, lateribus marginatis rectis, angulis sat acutis; scutellum flavo maculatum; alae subcinereae, ad venas transversus obscuriores.

'Black, shining, partly ferruginous: head testaceous in front, hardly broader than the thorax: antennae very minutely pubescent: prothorax minutely punctured, rugulose on the disc, not broader in front, with a rim on each side and along the fore-border; sides straight, angles rather sharp: scutellum with a yellow spot in front: wings very slightly gray, darker about the transverse veins: veins black. Length of the body 4½ lines, of the wings 13 lines.[1]

'*a, b.* Van Diemen's Land. From Dr. Hooker's collection.

'*c.* Van Diemen's Land. From Mr. Smith's collection.

'*d.* New Zealand. Presented by Capt. J. C. Ross.'

The New Zealand specimen and one of Dr. Hooker's examples can no longer be traced in the British Museum collection. McLachlan and Tillyard, however, were both of the opinion that Walker's *opposita* does not occur in New Zealand, and that the record was based on a mis-identification. This is very probable, as there is a strong superficial resemblance between species of different genera in the Gripopterygidae.

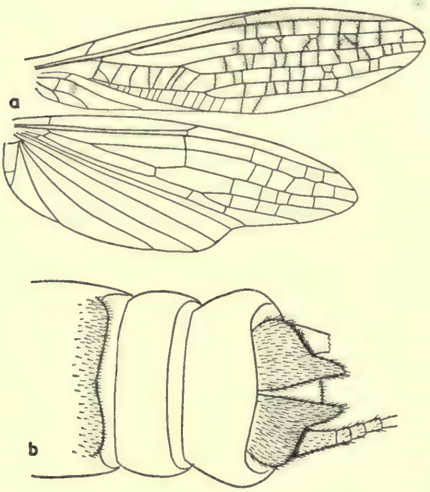


FIG. 15. *Dinotoperla opposita* (Walker) ♀. *a*, wings; *b*, genitalia, ventral.

To Walker's description may be added that the two remaining examples are females, one with the abdomen damaged by insects. The pronotum is broader than long, anterior margin rounded, making anterior angles obtuse. The subgenital plate is scarcely produced, broad, slightly emarginate at its centre, not or but slightly pigmented. Sub-anal plates broad, triangular, outer margins obtusely excised, apices broader and less divergent than in *D. serricauda* Kimmins. Cerci short, thirteen-segmented (damaged and possibly incomplete in type). Tenth tergite produced in a rounded, deflexed lobe.

Wings a little more pointed than in *serricauda* Kimmins, and with more numerous cross-veins in the apical half.

I have selected as type the female from Mr. Smith's collection, labelled V.D.L., 51.153; the abdomen has been made into a microscope preparation and one pair of wings has been mounted dry on a microscope slide.

I have seen no more examples of this species, which is seemingly restricted to Tasmania. Tillyard records it from Mt. Wellington, Hobart.

Dinotoperla fontana sp.n.

FIG. 16

(In fluid.) Head, thorax, and abdomen brownish, the latter with apices of segments whitish, whitish areas becoming progressively narrower from base to apex.

---

[1] The wing measurement is obviously the expanse, not the length.

Eyes blackish, antennae brown, about as long as fore wing. Pronotum about three-fifths as long as broad, narrowed anteriorly, anterior and posterior transverse furrows strong, linked by a narrow median line and somewhat shallow lateral troughs. Legs yellowish-brown, knees and tarsi somewhat darker; ventral surface of femora with a pair of dark brown lines.

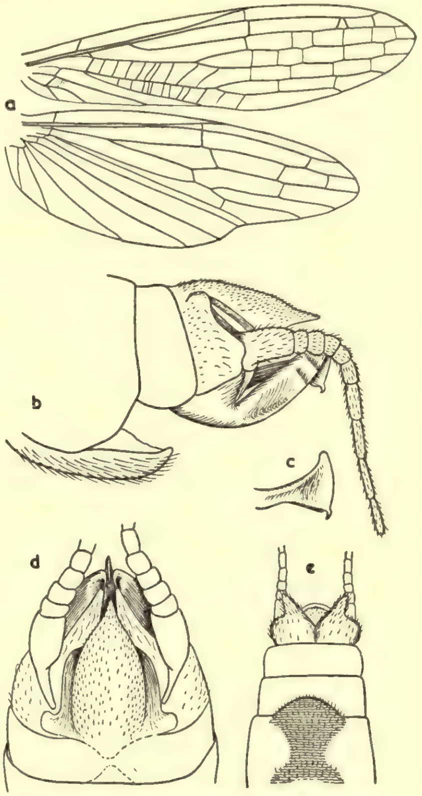


FIG. 16. *Dinotoperla fontana* sp.n. *a*, wings ♂; *b–d*, genitalia ♂, *b*, lateral, *c*, apex of supra-anal lobe, lateral, *d*, dorsal; *e*, genitalia ♀, ventral.

Wings yellowish fuscous, veins slightly darker. In fore wing, cross-veins in apical half numerous (more than twenty), not very strong, in dark specimens faintly bordered with brownish. In hind wing, Rs and M separate at some distance from the base.

♂. Apical margin of tenth tergite produced at its centre in a pale process, cylindrical, and tapering to an acute apex, which is more slender than in *serricauda*; its upper surface clothed with minute setae. At its base are two chitinous ribs supporting the supra-anal lobe. The latter is slender, its apex laterally compressed, from the side dilated, upper angle rounded, lower hooked. Cerci brownish, bent downwards, a little over 1 mm. in length, ten-segmented, segments becoming narrower and longer towards the apex. Sub-anal plates blade-like, upcurved, outer surface with two or three weak, transverse corrugations. Subgenital plate dark brown, parabolic, extending to bases of sub-anal plates.

♀. Pronotum more rugose than in male. Abdomen almost wholly pale except tenth, part of ninth segments, and the subgenital plate. The latter is produced in a broad parabola, about half the width of the sternite; the plate is strongly pigmented, extending to base of segment, the pigmentation constricted about midway. Sub-anal plates broad, apices acute and divergent. Cerci brownish, twelve-segmented. Tenth tergite pigmented basally, apical margin pale, the basal pigmentation extending in a narrow finger into the produced part.

Length of fore wing, ♂ 10·5 mm., ♀ 9 mm.

Length of hind wing, ♂ 9·5 mm., ♀ 8 mm.

AUSTRALIA: Federal Capital Territory, Lee's Springs, xi.1932, 3 ♂, 1 ♀; New South Wales, Mt. Kosciusko, 10–15.xii.1934, 1 ♀ (R. J. Tillyard).

Type male, paratype female (Lee's Springs) in microscope preparations, remainder in 2 per cent. formaldehyde solution.

The form of the supra-anal lobe and the more produced tenth tergite in the male, and the more produced and pigmented subgenital plate of the female will separate this species from *D. serricauda* Kimmins and *D. carpenteri* Tillyard.

Dinotoperla carpenteri Tillyard

FIG. 17

Dinotoperla carpenteri Tillyard, 1921, *Trans. Roy. Soc. S. Aust.* **45:** 273–274, figs. 1–4.

I have been unable to recognize this species with certainty amongst the British Museum material, and as I am unable at present to study the type, I am repeating Tillyard's description and figures. His illustration of the male genitalia is difficult to understand; it was made from a microscope preparation and one which appears to have been much flattened in mounting. Tillyard says it is a ventral view, but the median lobe bears considerable resemblance to the supra-anal lobe of *Dinotoperla* and one of the sub-anal plates (*superior appendages*) passes beneath it. The other one is drawn above the cercus, thus apparently being in ventral aspect. It is probable that in drawing from a flattened mount, Tillyard was mistaken in the relative position of the various parts. Under the circumstances I have considered it wiser not to attempt to re-figure the species from an example which might not be correctly determined, but to leave the elucidation of this species to an Australian or New Zealand entomologist who has access to the type.

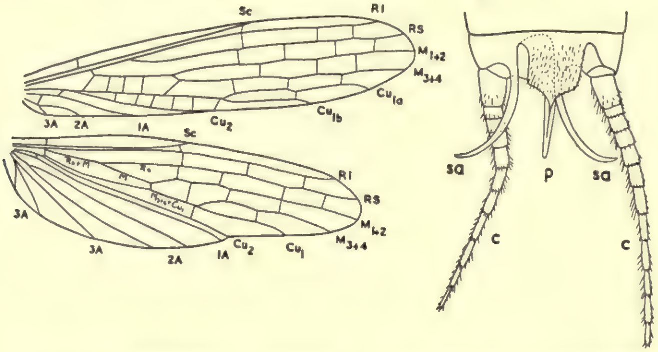


FIG. 17. *Dinotoperla carpenteri* Tillyard ♂. Wings and genitalia (after Tillyard). *c*, cerci, *p*, 'penis', *sa*, 'superior appendages', probably in dorsal view.

'*Forewing*, 10 mm. *Expanse*, 21·5 mm.

'Head, thorax and abdomen dull blackish, touched with dark brown behind the eyes and on notum. *Eyes* brownish-black. *Antennae* about as long as the forewing, very slender, about 50 segments, the basal one slightly enlarged. *Pronotum* rectangular, broader than long. *Legs* dull brownish, the apices of the femora and tibiae darkened; the tarsi darker, except at base of first segment. *Cerci* rather short, 10- to 11-segmented, tapering, delicately haired, the basal segment thickest and much longer than any of the next few succeeding segments. In the male, the *superior appendages* are slender, elongated, curved processes, projecting on either side of the penis, the basal portion of which is a broad plate, the distal portion slender and upcurved. In the female, the ventral plate is deeply bifid, a deep triangular notch dividing it into two triangular pieces.

'Wings: Forewing medium fuscous, with irregular paler sub-hyaline spaces between the cross-veins; i.e., each cross-vein is surrounded by a rectangle of the fuscous ground-colour, and the spaces between these rectangles are paler. As the positions and number of these cross-veins is inconstant, varying for each individual, the pattern thus produced is very irregular, and is never very conspicuous. *Hindwing* a uniform medium fuscous. When at rest, the dark and pale areas of the two wings appear to re-inforce each other, giving the insect a distinctly banded appearance.

'Locality: Hornsby, near Sydney, N.S.W. Bred from larvae found on rocks in a small stream in Old Man's Valley; also found sitting about on the stems of reeds and grasses near the stream. July to October.

'Types: Holotype (Hornsby, Sept. 14, 1917, R. J. T.) and series of paratypes in Tillyard collection, Cawthron Institute, Nelson, N.Z.

'The set specimens have the abdomens so shrivelled that it is impossible to determine the sex or study the sexual appendages. The descriptions of these organs given above were made from slides prepared from specimens of the paratype material.'

Dinotoperla brevipennis sp.n.

FIG. 18

Head and pronotum light yellowish-brown, with considerable darker brown markings; remainder of thorax brown. Antennae brown, a little shorter than fore wings. Pronotum quadrate, two-thirds as long as broad, surface finely rugulose or granulose, posterior angles obtuse. Legs brownish, knees and two lines on lower surface of femora darker. Abdomen largely brownish above, paler beneath. Wings short, extending only to apex of abdomen, light fuscous (hind wing darker), with darker venation, In fore wing, apical cross-veins pale, all cross-veins bordered with brownish.

♂. Apical margin of tenth tergite produced at its centre in a pale process, shorter than in *serricauda*, apex rounded, not acute; upper surface finely setose. Supra-anal lobe short, laterally compressed, and blade-like, its apex from the side expanded and produced downward in a hook. Cerci brownish, bent downward, about 1 mm. in length,

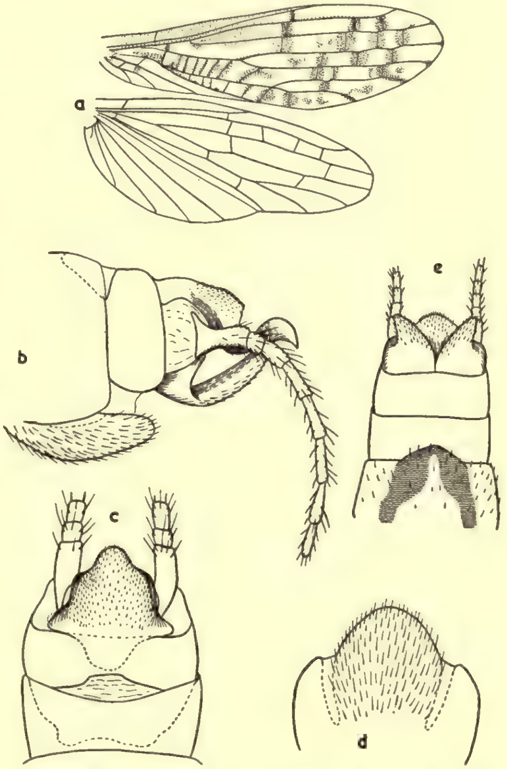


FIG. 18. *Dinotoperla brevipennis* sp.n. *a*, wings ♂; *b–d*, genitalia ♂, *b*, lateral, *c*, dorsal, *d*, subgenital plate, ventral; *e*, genitalia ♀, ventral.

nine- or ten-segmented, those beyond the fifth of about equal length. Sub-anal plates blade-like, upcurved, with acute apices. Subgenital plate dark brown, parabolic, extending to bases of anal plates.

♀. Abdomen whitish, except tenth segment, subgenital plate and ninth tergite, which are brown. Sternites two to seven with four tiny brownish plates. Subgenital plate rather less produced than in *D. fontana* Kimmins, about half the width of the segment. It is strongly pigmented, rather broader at base than apex, and with a large hyaline area at the base, extending in a narrow finger almost to apex. Sub-anal plates broad, apices divergent, rather stouter than in *fontana*. Cerci brownish, about nine-segmented. Tenth tergite roundly produced at its centre, apical margin narrowly whitish.

Length of fore wing, ♂ 5 mm., ♀ 5·5 mm

Length of hind wing, ♂ 4·2 mm., ♀ 4·6 mm.

AUSTRALIA: New South Wales, Bolaro, 22.xii.1935, 3 ♂, 6 ♀; Rule's Point, 4,450 ft., 30.xii.1934, 2 ♂ (R. J. Tillyard).

Type male, paratype female from Bolaro, in form of microscope preparations, remainder in 2 per cent. formaldehyde solution.

Dinotoperla thwaitesi sp.n.

FIG. 19 *a–c*

♂ (dried). Resembling *D. brevipennis* Kimmins but with longer wings and differences in genital structure. Head and pronotum light brownish, with considerable darker markings. Antennae brown, incomplete. Pronotum quadrate, about three-fourths as long as broad, median line short, angles obtusely rounded. Meso- and metanota dark brown. Legs brownish, darker at knees and with darker lines beneath femora. Abdomen brownish above, paler beneath, particularly towards base. Wings more elongate than in *brevipennis*, and with more numerous apical cross-veins. In hind wing, anal fan is flatter and less evenly rounded; point of separation of M3+4 and Cu1 before intercubital cross-vein. Wings brownish (hind darker), venation brown and most of cross-veins bordered with brownish.

Apical margin of tenth tergite scarcely produced, membranous at its centre. Supra-anal lobe slender from above, rather longer than in *brevipennis*, from side sinuous and terminating in an acute down-turned hook. Cerci brownish, bent downwards, about 1·5 mm. long, twelve-segmented, more finely haired than in *brevipennis*. Sub-anal plates blade-like, acute, upcurved, rather broader about midway. Subgenital plate dark brown, narrower and more pointed than in *brevipennis*.

Length of fore wing 9 mm., of hind wing 8 mm.

AUSTRALIA: Victoria, Melbourne (Thwaites), 1 ♂.

Type (with abdomen mounted in balsam) in collection of Hope Department, University Museum, Oxford.

Dinotoperla uniformis sp.n.

FIG. 19 *d–g*

♂ (in fluid). Head, thorax, antennae, and legs pale brownish, head and thorax with obscure, slightly paler markings, abdomen whitish, ninth and tenth segments pale brownish. Antennae about as long as fore wing. Pronotum a little broader than long, narrowed anteriorly, transverse furrows distinct, lateral margins slightly raised, a narrow median impressed line. Legs practically without markings, either at knees or beneath femora. Wings pale fuscous, veins darker, a few paler areas in fore wing. Ten to twelve rather weak cross-veins in apical half of fore wing. In hind wing, Rs and M separate some distance from base.

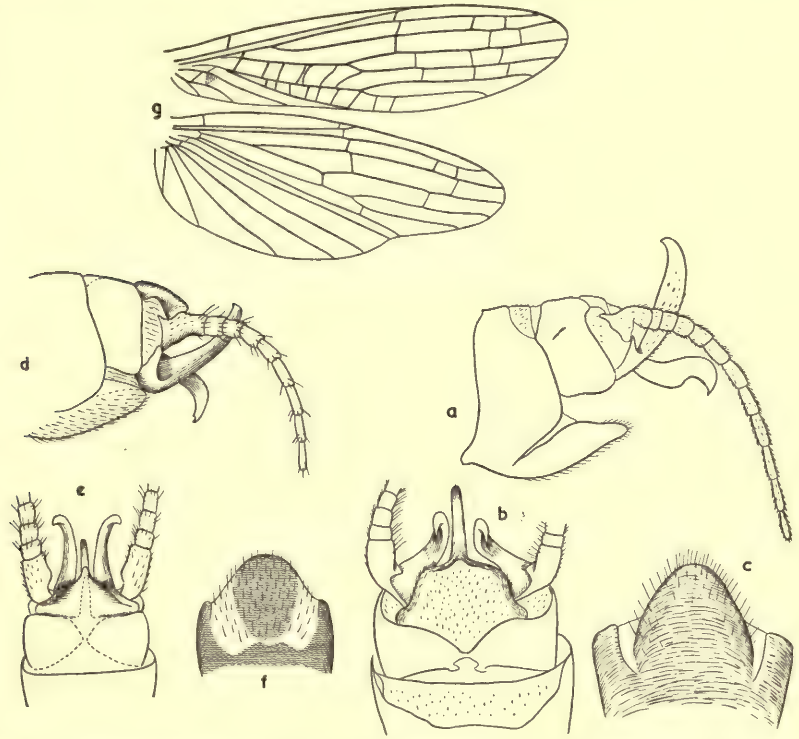


FIG. 19. *Dinotoperla* spp.n. ♂. *a–c, D. thwaitesi; d–g, D. uniformis.* Genitalia, *a*, lateral; *b*, dorsal; *c*, subgenital plate, ventral; *d*, lateral; *e*, dorsal; *f*, subgenital plate, ventral; *g*, wings.

Tenth tergite from above triangularly produced at its centre, pale brownish, only its extreme apex and a narrow median area whitish. From the side it is much less produced than in the other species. Supra-anal lobe slender, down-curved towards its apex, which is acute, and excised on its lower surface. Cerci pale brownish, bent downwards, about 1 mm. in length, ten-segmented. Sub-anal plates slender, upcurved, apices acute and divergent. Subgenital plate produced and rounded, an ovate pigmented patch at its centre.

♀ unknown.

Length of fore wing 9 mm., of hind wing 8 mm.

AUSTRALIA: New South Wales, Rule's Point, 4,450 ft., 30.xii.1934, 1 ♂ (R. J. Tillyard).

Type in form of microscope preparation.

Dinotoperla evansi sp.n.

FIGS. 20 *a–c*, 21 *a*

♂ (in fluid). Head and thorax light reddish-brown. Head practically without markings, antennae long, reddish-brown, basal segment dark brown. Pronotum broader than long, slightly narrowed anteriorly, sides straight, anterior margin slightly produced and rounded; anterior and posterior transverse furrows distinct. Colour reddish-brown, with a median longitudinal streak of yellowish-brown. Meso- and metanota reddish-brown. Legs light reddish-brown, knees darker and two dark lines on ventral surface of each femur and one on each tibia. Abdomen with segments one to five whitish, remainder largely dark brown. Wings smoky-brownish (hind wings the darker) with darker venation, costal and stigmal areas darker; apical cross-veins pale, in fore wings bordered with brownish.

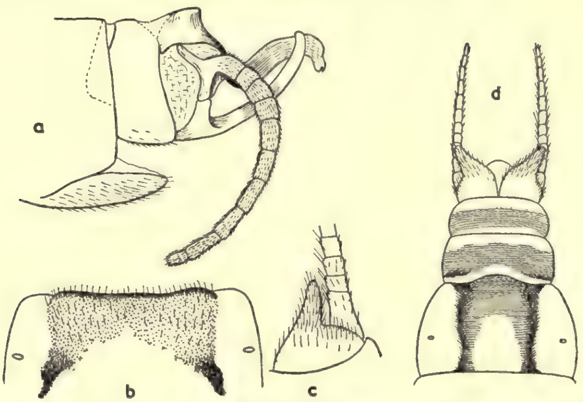


FIG. 20. *Dinotoperla* spp.n. *a–c*, *D. evansi*; *d*, *D. nigricoxa*. *a*, ♂ lateral; *b*, ♀ subgenital plate, ventral; *c*, ♀ sub-anal plate, ventral; *d*, genitalia ♀, ventral.

Apical margin of tenth tergite elevated, but without a pale, produced process, its place being taken by a flat membranous area. Supra-anal lobe rather long, compressed laterally, apex curved downward, rounded, and carrying a small hook. Cerci brownish, bent downward, rather more than 1 mm. in length, about ten-segmented. Sub-anal plates blade-like, upcurved, with rounded apices. Subgenital plate dark brown, rather narrow, with a very flatly rounded apex.

♀. General appearance similar, wings rather darker; abdomen with only segments nine and ten, subgenital plate, sub-anal plates, and cerci dark brown. Subgenital plate broad, not produced, pigmented area with a broad triangular excision at base. Sub-anal plates with slender produced apices. Cerci slender, about thirteen segments.

Length of fore wing, ♂ 10·5 mm., ♀ 10·5 mm.

Length of hind wing, ♂ 9 mm., ♀ 9 mm.

S. AUSTRALIA: Mt. Lofty, x.1931, 1 ♂ (J. Evans); Cudlee Creek, 20.xi.1934, 6 ♀ (R. J. Tillyard); Adelaide, 2 ♀ (Hope Dept., Univ. Mus., Oxford).

Type male, paratype female in form of microscope preparations, others in 2 per cent. formaldehyde solution, females from Adelaide pinned.

This species resembles *D. uniformis*, but may be distinguished by the form of the supra-anal lobe and subgenital plate in the male, and by the venation. One of the females from Adelaide is larger than those from Cudlee Creek (fore wing, 11·5 mm.) and has more numerous apical cross-veins, but the form and pigmentation is similar.

Dinotoperla fusca sp.n.

FIG. 21 *b, c*

♂ unknown.

♀ (in fluid). Head fuscous, with darker markings near antennal bases and behind epicranial sutures. Antennae fuscous, with blackish basal segment. Pronotum fuscous, anterior and posterior margins finely bordered with blackish-brown, and with blackish rugosities on the disk; quadrate, broader than long, anterior and posterior transverse furrows rather broad. Meso- and metanota dark brown. Femora yellowish-brown, ventral carinae and apical third of femur dark brown, tibiae and tarsi dark brown. Wings brownish hyaline, anterior with whitish areas in most of the apical, medio-cubital, and cubital cellules. Venation brownish, many of the apical cross-veins weak and whitish, those in the anterior wing numerous. Abdomen whitish, pattern of subgenital plate and parts of the ninth and tenth segments, and cerci brownish-black. Eighth sternite forming a subgenital plate whose margin is only very slightly produced. There is a strongly pigmented pattern resembling that in *D. evansi*, but the pigmented area is much longer than broad, the lateral margins

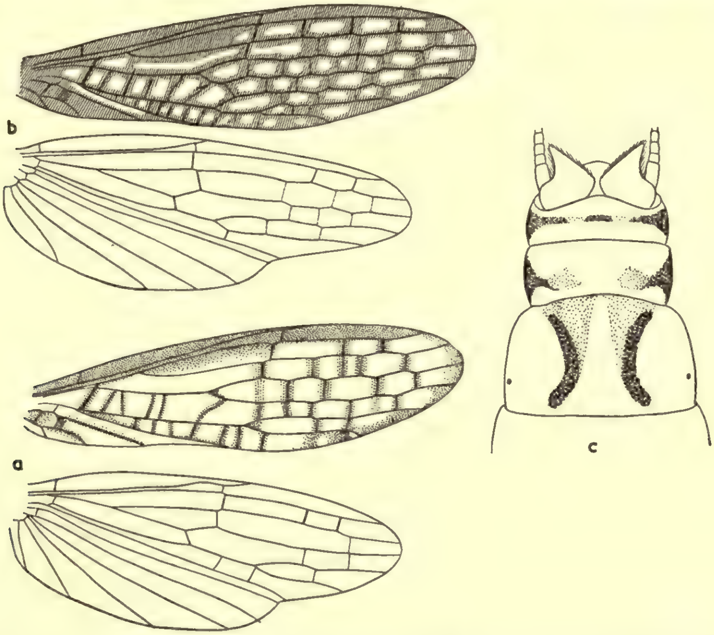


FIG. 21. *Dinotoperla* spp.n. ♀. *a, D. evansi* wings; *b, D. fusca* wings; *c, D. fusca* genitalia, ventral.

are more concave and the pale median area is narrower and extends to the apex. Pigmentation of the ninth sternite interrupted centrally, of tenth complete. Sub-anal plates broad, subtriangular, outer margins concave, inner straight. Cerci short, about eleven-segmented.

Length of fore wing 10·5 mm., of hind wing 9·5 mm.

TASMANIA (J. W. Evans), 2 ♀.

Type in form of microscope preparation, paratype in 2 per cent. formaldehyde solution.

This species resembles *D. evansi* and *D. nigricoxa* in the pattern of the female subgenital plate. From the former it may be separated by the rather more pointed wings and different pattern. In *nigricoxa* the wings are almost without pattern and there are far fewer apical cross-veins.

Dinotoperla nigricoxa sp.n.

FIG. 20 *d*

♂ unknown.

♀ (in fluid). Head yellowish-brown, chestnut-brown between ocelli, occiput mottled with darker yellowish-brown. Antennae dark brown, about as long as fore wing. Pronotum transverse, slightly narrowed anteriorly, anterior margin convex; transverse furrows broad and distinct, a short median impressed line; disk on either side with obscure brownish markings, surface finely rugulose. Legs dull brownish, darker on knees and tarsi: each femur below with two narrow black streaks, posterior streak obsolete at base. Meso- and metacoxae on upper surface at base with a distinct black streak. Mesosternum on each side with a dark brown streak.

Wings brownish, with brown venation; apices slightly more acute than in *uniformis*; in three out of four examples, Cu1 in fore wing forks some way beyond the fork of M and termination of Cu2. (Lines drawn from these points to the fork of Cu1 form approximately a right angle; in *uniformis* this angle is decidedly obtuse.) In hind wing Rs and M separate some distance from base.

Abdomen whitish, except eighth sternite and parts of ninth and tenth segments, which are brownish. Eighth sternite more or less produced at its centre in a subgenital plate, pigmented as in Fig. 20 *d*. Sub-anal plates broad, apices triangular and divergent. Cerci short, nine- or ten-segmented.

Length of fore wing 10 mm., of hind wing 9 mm.

AUSTRALIA: New South Wales, Mt. Kosciusko, 10–15.xii.1934, 4 ♀ (R. J. Tillyard).

Type female in form of a microscope preparation, paratypes in 2 per cent. formaldehyde solution.

This species may possibly be the female of *D. uniformis*, but as there are a number of minor differences, it has been considered preferable to regard it as distinct. The chief differences are in the shape of the pronotum, which is less narrowed anteriorly, the black streaks on the femora and the black markings on the meso- and metacoxae.

Dinotoperla fasciata Tillyard

FIG. 22

Dinotoperla fasciata Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48:** 193; 1926, *Ins. Aust. & N.Z.*: 119, pl. 10, fig. 13.

The female holotype has been severely damaged by *Anthrenus*, and little but the wings remain. Tillyard describes it as follows:

'♀. Length of body 6 mm., of forewing 10 mm., antenna 7 mm., cerci 1 mm. Head black, antennae dark brown; pronotum pale yellowish; rest of thorax black, abdomen dark brown. Forewings suffused with pale fuscous, venation darker fuscous; distal cross-veins surrounded by darker fuscous areas and so arranged that from three to four irregular transverse fasciae cross that part of the wing. Hindwings darker fuscous with a few darkened cross-veins placed distally between C, R1, and Rs.'

To this may be added that there are two or three cross-veins in the pterostigmatic area in both wings, and that there are distal cross-veins in the hind wing other than those specially mentioned by Tillyard.

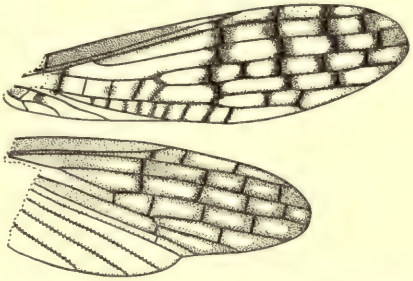


FIG. 22. *Dinotoperla fasciata* Tillyard. ♀ Type. Wings.

Holotype female (National Park, S. Queensland, 1,500–2,000 ft., Dr. A. J. Turner), in the British Museum (Nat. Hist.), from the Tillyard collection. Paratype female, slightly smaller in size and with less distinct fasciae (same locality, March, 1921, G. H. Hardy) in Queensland Museum, Brisbane.

Dinotoperla sp. nymph

FIGS. 23–24

General colour yellow-brown, with scanty darker markings; of medium build, not very slender, about 7 mm. long; sparsely clothed with small hairs, expanded at their bases, apices slender, generally curved or hooked.

Head a little wider than pronotum, widest at compound eyes, rounded behind; stem of epicranial suture about two-sevenths as long as pronotum. Antennae moderately long, extending beyond the apex of the posterior wing pads; first segment large, flattened dorso-ventrally, slightly tapering, second segment short, third about as long as second, remainder short, tapering to apex; each segment almost bare, with only a few short bristles at apex.

Labrum short, broad, anterior angles rounded. Labium with the glossae and paraglossae of about equal length, apices ciliate. Incision between glossae deeper than that cutting off paraglossae, both very narrow; paraglossae rather broader than glossae, outer margins strongly convex. Labial palpus three-segmented, segments increasing in length from base to apex in ratio 1 : 1·5 : 2; second segment dilated towards its apex, third ovate. Maxillae well developed: lacinia with two acute teeth at its apex, beneath which, on inner surface, is a short row of stiff setae; galea scarcely extending beyond lacinia, curved, tapering towards its apex, which is obliquely truncate and set with minute setae; palpifer indistinct, membranous; palpus five-segmented, one and two short, subequal, three as long as one and two combined, four rather longer than two, and five as long as three and four together. Mandibles heavily chitinized, with a number of strong teeth near the apex, beneath which is a well-developed mola with a row of short setae.

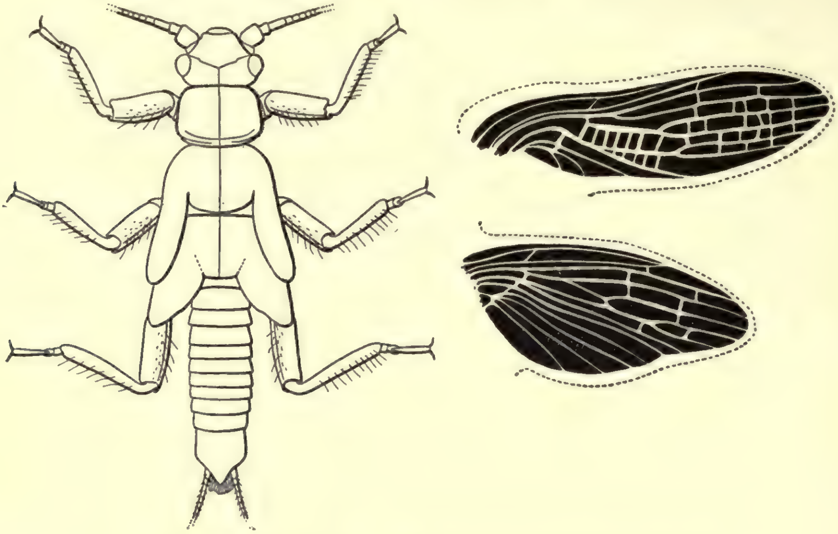


Fig. 23. *Dinotoperla* sp. Nymph and nymphal venation.

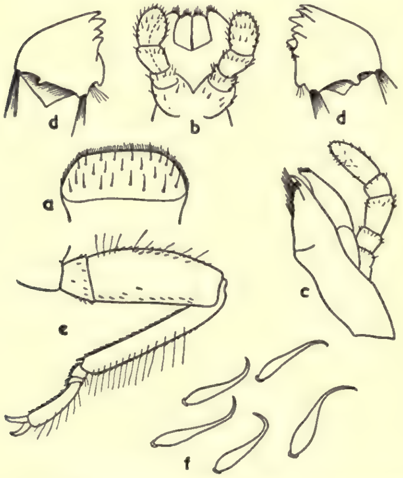


Fig. 24. *Dinotoperla* sp. Nymphal structures. *a*, labrum; *b*, labium; *c*, maxilla; *d*, mandibles; *e*, leg; *f*, vestiture.

Pronotum with a number of straggling brownish marks on disk, median suture pale; broader than long, slightly narrowed anteriorly, angles rounded. Wing pads extending backwards and almost horizontal. Fore wing pads elongate, overlapping more than half of the posterior pads; latter somewhat broader, anal fan not very pronounced. Main venation visible as lines of pigmentation bearing short hairs. If viewed by transmitted light, the veins and cross-veins appear as clearer spaces in the tissue of the wing. Under these conditions, the cross-vein designated M5 by Tillyard is very evident and is generally thicker than the succeeding medio-cubital veins.

Legs short and strong, prothoracic the shortest, increasing in length to the metathoracic, sparsely clothed with short dilated hairs, outer surface of tibiae with a scanty row of longer, very fine setae. Femora shorter and broader than tibiae, anterior surfaces with a brownish line, not reaching the apex. Tibia with a slender band below the knee and a narrow longitudinal streak on anterior surface. Tarsi three-segmented, second very short, third about four times as long as first, and provided with a pair of simple claws at apex.

Abdomen cylindrical, segments one to nine with straight apical margins, and dorsally with a double row of spots, fairly close together. Tenth tergite as long as five preceding tergites, apical margin produced and somewhat elevated in male, rounded in female. Sub-anal plates elongate, triangular. Projecting beyond them is a dense tuft or rosette of mauve anal gill-filaments. Cerci short, tapering to apex, about twenty segments, basal segments shorter than broad, apical segments longer than broad, segments with a few short apical setae, no dorsal fringe.

AUSTRALIA: F.C.T., Cottar River, 14.ix.1933 (W. L. Raitt); other examples, rather darker, from New South Wales, Rule's Point, 4,450 ft., 30.xii.1934, and TASMANIA, R. Ouse, 4.ii.1933 (R. J. Tillyard).

TRINOTOPERLA Tillyard

Trinotoperla Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48:** 193.
Type species: *T. irrorata* Tillyard, 1924 (fixed by Tillyard, 1924).

Fore wings with Rs forked, sometimes three-branched, M forked near middle of wing. Cu1 two- or three-branched (sometimes in males the lowest branch is very short and forms a closed cell with the one above it); cubito-anal space with only a basal cross-vein; a thickened cross-vein between 1A and 2A. Hind wing with Rs forked, M forked, posterior branch soon fusing with Cu1, and separating again, generally some distance from the wing margin; apex narrowly rounded; anal fan moderately or rather narrow, generally without any cross-veins. Cerci short. Size of species medium to large, expanse from about 25 mm. to over 50 mm.

Distribution: Australia; ? Tasmania, known from nymphs only.

Trinotoperla irrorata Tillyard

FIG. 25

Trinotoperla irrorata Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48:** 194, fig. 1; 1926, *Ins. Aust. & N.Z.*: 119, pl. 10, fig. 14.

The type and allotype have suffered severely from the depredations of *Anthrenus*, little remaining apart from the wings. I am therefore quoting the original description and adding extra notes where possible.

'♀ Holotype: Length of body 20 mm., of forewing 25 mm., antennae 17 mm., cerci barely 3 mm. Body dark fuscous, marked with dull brown; antennae dull brownish with slight fuscous annulations; legs dull brownish varied with dark fuscous. Wings pale greyish with dark fuscous veins, those of the basal half of the hind wing inclining to brownish' (the whole of the fore wing and to a lesser degree, the distal part of the hind wing, speckled with dark brown spots, and most of the cross-veins margined with darker brown. Posterior margin of fore wing with a small distinct angular lobe between Cu1 and Cu2, rather more pronounced than in Tillyard's figure). 'Forewing with a complete series of costal veinlets; hindwings with *hm* and three or four distal costal veinlets only.' (Costal margin of hind wing very slightly scalloped.) 'Thickened cross-vein between 1A and 2A in forewing blackish, very prominent.'

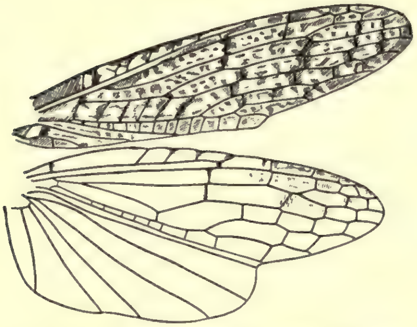


FIG. 25. *Trinotoperla irrorata* Tillyard. ♀ Type. Wings.

'♂ Allotype. Smaller and slightly paler and less strongly irrorated than female. Length of body 17 mm., forewing 21 mm. Supra-anal plate with a slender copulatory process directed upwards and ending in a small hook directed posteriad; paraprocts upcurved, forming two flatly rounded lobes directed forward and upward. Tenth tergite with a raised flap distally.'

AUSTRALIA: New South Wales, Mt. Kosciusko, 5,000–5,500 ft., 24.xi.1921 (R. J. Tillyard). Holotype female, allotype male in British Museum (Nat. Hist.), from the Tillyard collection.

Trinotoperla australis Tillyard

FIGS. 26–28

Trinotoperla australis Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48:** 194; 1926, *Ins. Aust. & N.Z.*: 119, pl. 10, fig. 15.

Female holotype: Head, thorax, and abdomen fuscous; antennae fuscous, three-quarters as long as fore wing. Pronotum a little broader than long, quadrate, anterior

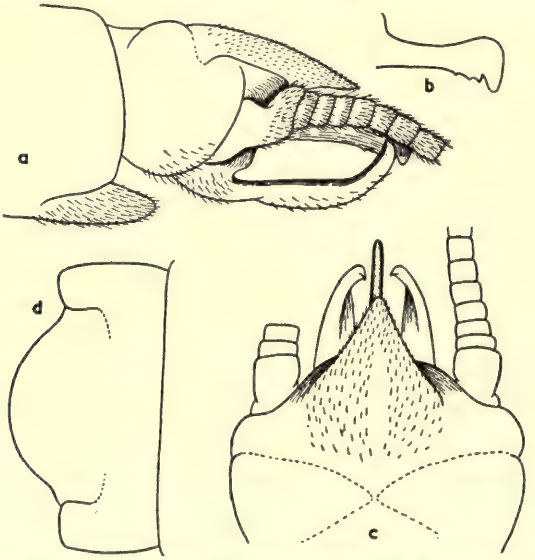


FIG. 26. *Trinotoperla australis* Tillyard. ♂ genitalia. *a*, lateral, *b*, apex of supra-anal lobe, lateral, *c*, dorsal, *d*, subgenital plate, ventral.

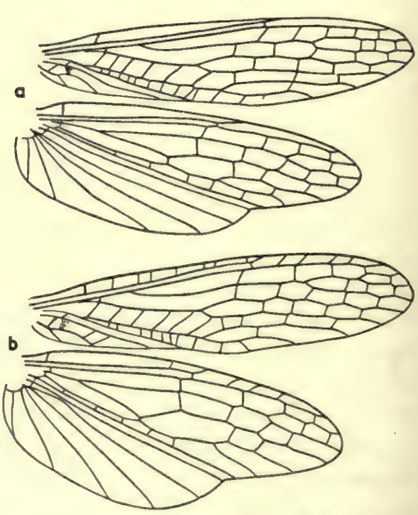


FIG. 27. *Trinotoperla* spp. ♀ Wings. *a*, *T. australis* Tillyard; *b*, *T. nivata* sp.n.

and posterior margins slightly rounded, a median impressed line, not reaching anterior margin, and posteriorly ending in a transverse groove. Legs fuscous. Wings pale brownish-fuscous, venation darker, cross-veins narrowly bordered. Very few costal cross-veins, no pronounced angular lobe on posterior margin of fore wing. Costal margin of hind wing evenly arched. Thickened cross-vein between 1A and 2A in fore wing brownish, less conspicuous than in *irrorata*.

Subgenital plate of the female holotype is creased and probably distorted. The apical margin is slightly produced and rounded, and appears to have a small rounded excision at its centre. I strongly suspect that this excision is accidental, as I have examined a number of examples from South Australia, agreeing in other respects, in which the subgenital plate is evenly rounded and not excised. I am figuring the subgenital plate of one of these for comparison. In most of these there is a strongly pigmented bar near each lateral margin. Sub-anal plates broad at their bases, with rather broad rounded apices, which are divergent. Cerci filiform, brownish, incomplete in the type, in other examples about fifteen-segmented. Apical margin of tenth tergite deflexed, rounded, with a slight projection at its centre.

Male. Tenth tergite produced in a pale triangular process, rather flattened and acute from the side. Supra-anal lobe long, slender from above; from the side rather deep and somewhat dilated at its apex. Just before the apex on the ventral surface is a small acute excision, giving the apex the appearance of a blunt hook. Basad of this excision are a few minute teeth. Sub-anal plates long, slender, and a little upcurved from the side, apices incurving and acute. From beneath they are broad at their bases, inner lower surfaces membranous. Cerci short, brownish, curving downwards, basal segment rather constricted from the side, about seventeen segments. Subgenital plate broad, apical margin rounded, and moderately produced. The basal margins are more heavily pigmented than the remainder of the tergite.

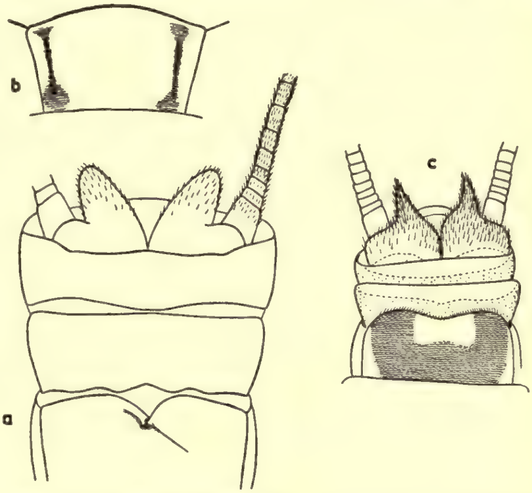


FIG. 28. *Trinotoperla* spp. ♀. *a–b*, *T. australis* Tillyard; *c*, *T. nivata* sp.n. *a*, genitalia ventral of holotype; *b*, subgenital plate of another example; *c*, genitalia ventral.

Length of fore wing, ♂ 18 mm., ♀ 18–20 mm.

Length of hind wing, ♂ 16 mm., ♀ 17–18 mm.

AUSTRALIA: The locality of the holotype is New South Wales, Towac, near Mount Canoblas, 7.x.1916 (R. J. Tillyard). I have seen other specimens from Mt. Kosciusko, Spencer's Creek, xii.1932, and Bolaro, 22.xii.1935, and from the Murrumbidgee River, F.C.T., i.1922, all collected by R. J. Tillyard, and other pinned examples from the McLachlan Collection, labelled Melbourne, S. Australia, or merely Australia.

This species bears a superficial resemblance to the new species *nivata* and *minor*, but may be distinguished by the male genitalia, and by the rounded sub-anal plates of the female. The wings are rather narrower.

Trinotoperla nivata sp.n.

FIGS. 27, 28

♂ unknown.

♀ (in fluid). Head reddish-brown, with a small area on the clypeus, and the post-ocellar sutures pale. Antennal brown, long (incomplete in the type). Thorax fuscous, pronotum a little broader than long, slightly narrowed anteriorly, angles not produced; a short, median, impressed line, all margins somewhat elevated. Legs medium fuscous, knees darker, a pale spot in centre of anterior surface of each femur. Lower anterior apical angle of each femur produced in a small tooth. Abdomen whitish, except tenth tergite, eighth to tenth sternites, sub-anal plates and cerci, which are brownish. Wings greyish-brown, not irrorated, anterior darker than posterior; veins darker, faintly shaded. A number of costal cross-veins in fore wing; posterior margin of this wing scarcely produced in a lobe about the end of Cu1. Angle between anal fan and posterior margin of hind wing clearly greater than a right angle.

Subgenital plate about twice as broad as long, apical margin not very produced, broadly excised at its centre; brown, with a quadrate area at the centre of the apical margin, and the lateral margins pale. Sub-anal plates broad at bases, apices produced in acute fingers, curving upward and slightly inward. Cerci short, about 1·7 mm., sixteen or seventeen segments, basal segments much broader than long.

Length of fore wing, 16 mm., of hind wing, 15 mm.

AUSTRALIA: Victoria, Snowy River, 3.i.1933, 1 ♀ (R. J. Tillyard).

Type is a microscope preparation.

T. irrorata Tillyard, which this species somewhat resembles, may be separated by its larger size, distinctly mottled fore wing, a small but distinct rounded lobe on the posterior margin of fore wing, and by the angle between the anal fan and the posterior margin of the hind wing being only a little greater than a right angle. The female holotype of *irrorata* suffered greatly from the ravages of *Anthrenus* whilst in Tillyard's possession, and little now remains of the body. The sub-anal plate appears to be of the pattern of *nivata*, but the apex is less acute.

Trinotoperla minor sp.n.

FIG. 29

(In fluid.) General appearance much as in *T. nivata*. Legs with the pale area of the femur less pronounced, upper surface darker, lower apical angle toothed. Abdomen whitish, except eighth to tenth segments in male, and tenth tergite, eighth to tenth sternites in female, which are brownish. Wings rather more elongate than in *nivata*, a little paler, and without costal cross-veins, apart from the humeral. In the hind wing there may be a cross-vein between 1A and 2A near their apices. The angle formed by the posterior margin and the anal fan is more obtuse.

♂. Tenth tergite from above produced in a rather narrow, membranous lobe or flap, rather flattened from the side. Supra-anal lobe slender, somewhat dilated before its apex, which curves downward in an acute spine. Cerci pale brownish, curving gently downward, seventeen-segmented, segments at the base very short and broad, gradually increasing in length and becoming narrower towards the apex. Sub-anal plates rather broad, especially from beneath, curving upward on either side of the supra-anal lobe, and with rounded apices. Subgenital plate strongly produced, triangular, with a truncate apex.

♀. Very like *T. nivata*. Subgenital plate without a pale quadrate area at the centre of the apical margin. In *nivata* this pale area seems to be more closely set with fine hairs than its surroundings, but in *minor* the clothing is uniform. Apices of the sub-anal plates a little more incurved, and slightly longer in comparison with their bases. Cerci similar, seventeen-segmented, about 1·6 mm. long.

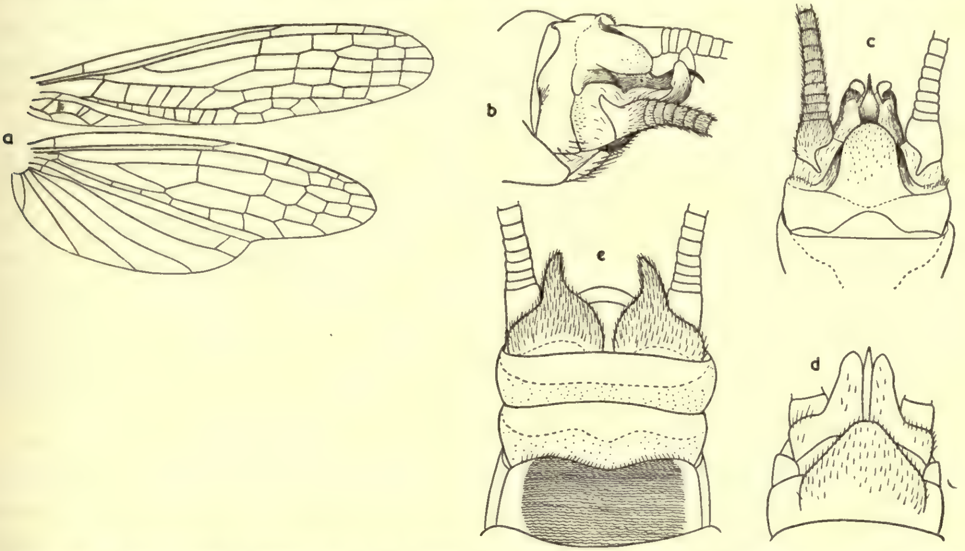


FIG. 29. *Trinotoperla minor* sp.n. *a*, wings ♂; *b–d*, genitalia ♂, *b*, dorso-lateral, *c*, dorsal, *d*, ventral; *e*, genitalia ♀, ventral.

Length of fore wing, ♂ 11 mm., ♀ 12 mm.

Length of hind wing, ♂ 10 mm., ♀ 11 mm.

AUSTRALIA: New South Wales, Bolaro, xii.1935, 2 ♂, 3 ♀ (R. J. Tillyard).

Type male, paratype female as microscope preparations, remainder in 2 per cent. formaldehyde solution.

Trinotoperla minor nymph

FIGS. 30–32

(Mature nymph, about to emerge.) General colour brownish, pronotum and legs paler; medium build, legs longer than in *Dinotoperla*, length of nymph about 9 mm. A conspicuous fringe or crest of fine setae along the median dorsal line of body, and along legs, cerci, and basal segments of antennae. Body clothed with a sparse mixture of fine hairs and short stout ovate setae. Head dark brown, broader than pronotum, widest at compound eyes, slightly rounded behind; stem of epicranial suture about one-third as long as pronotum. Antennae about as long as body, filiform, tapering; first segment large, with a dorsal crest of fine setae, second smaller, but longer than any of the next few succeeding segments, which become progressively longer and narrower from base to apex.

Labrum short and broad, anterior angles rounded. Labium with glossae slightly shorter than paraglossae, but of about equal width, apices with a dense tuft of fine setae. A narrow incision separating the glossae to their bases, and a wider one dividing them from the paraglossae, whose outer margins are convex. Palpus three-segmented, segments of roughly equal width, increasing in length from base to apex in ratio 1 : 1·5 : 2. Maxillae well developed, lacinia with a pair of broad truncate teeth at its apex, beneath which on its inner surface is a row of stout setae. Maxillary palpus five-segmented, arising from a membranous palpifer; first and second segments subequal, third somewhat shorter than the first and second together, fourth a shade longer than the second, and the fifth as long as the third.

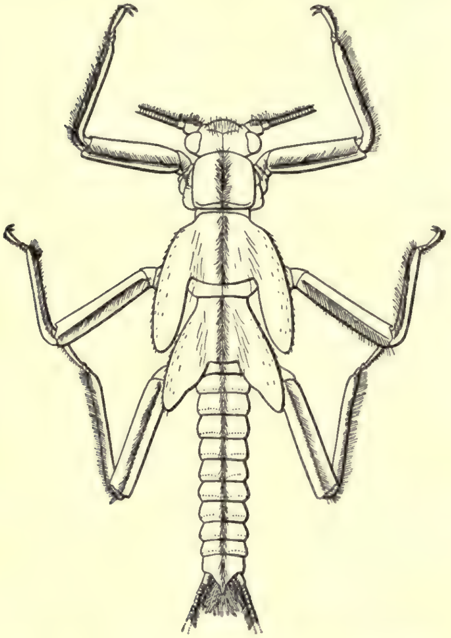


FIG. 30. *Trinotoperla minor* sp.n. Nymph.

Pronotum pale yellowish-brown, with a short, impressed, dark brown median line, and on either side of it a curved brownish band, its convex surface inwards, and a smaller streak near the posterior angles. Pronotum quadrate, slightly broader than long, angles rounded; posterior transverse furrow more noticeable than anterior. Wing pads extending backwards, almost horizontal. Fore wing pad elongate, covering about half of posterior pad; the latter is broader, the anal fan extending a full half of the posterior margin. Enclosed wings folded ready for emergence, venation appearing as pale lines on brownish ground of wing cover. (The venation figure has been drawn from a younger nymph, in which the pads are naturally smaller and relatively broader.)

Legs moderately short, prothoracic the shortest, each with a dense crest of fine long setae situated on the dorsum of each coxa, trochanter and tarsus, anterior dorsal margin of femur and anterior surface of tibia. Femur shorter than tibia, with a broad, light brown band before the knee, and a faint stripe of the same colour near the fringe, lower apical angle slightly produced. Tibia with a brownish band at the knee and the outer surface narrowly brown. Tarsus brownish, second segment shorter than the first, third about three times as long as first and second together, claws simple.

Abdomen cylindrical, brownish, segments one to nine with whitish apical margins, tenth tergite rather longer than eighth and ninth together, the centre of its apical margin produced in a rounded lobe, which is itself further produced in a slender finger. A dense tuft of whitish anal gill-filaments. Sub-anal plates brown, roughly triangular, apices divergent, rounded, whitish, outer margins broadly excised. Cerci long, with more than forty segments, slender, with a dense dorsal crest of fine, long setae; each segment ventrally at its apex with a few short setae.

AUSTRALIA: New South Wales, Bolaro, 22.xii.1935 (R. J. Tillyard).

The material furnishing this description was collected at the same time and place as the adults of *T. minor*. It consists chiefly of fully matured nymphs, so mature that the wings within the pads are folded ready for emergence. There are also from the same locality two or three smaller nymphs, probably about half-grown, in which the imaginal venation can be discerned, and this venation closely resembles that of *T. minor* adults. I think there can be little doubt that these are the nymphs of *T. minor*.

Trinotoperla sp. No. 1

FIGS. 31–32

Last instar nymph: Related to *T. minor* but differing in details, notably venation of hind wing, form of mouth-parts and vestiture. General colour light brownish, with darker markings, length about 13 mm. Median dorsal fringe less prominent; body sparsely clothed with a mixture of short curved setae and short dilated hairs. The latter are somewhat excised at their apices and trough-shaped in cross-section; those of *T. minor* are relatively larger and cylindrical in section. Head dark brown, paler at centre of vertex, broader than pronotum, stem of epicranial suture between one-third and one-quarter as long as pronotum. Antennae longer than body (about 16 mm.), filiform, tapering, first segment large, with a crest of fine setae, second smaller, but broader and longer than any of the next few succeeding segments, which also carry a dorsal fringe. Terminal segments longer than broad.

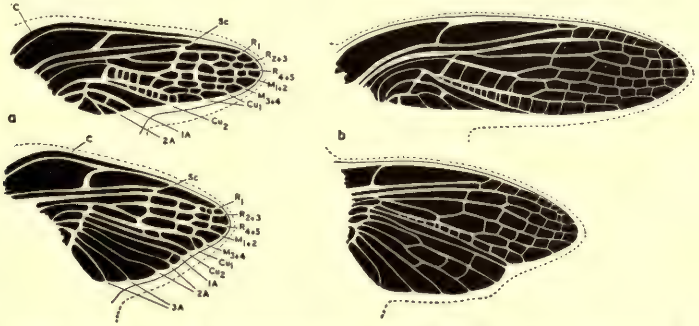


FIG. 31. *Trinotoperla* spp. Nymphal wing pads. *a*, *T. minor* sp.n.; *b*, *T.* sp. No. 1.

Labrum short and broad, narrowing to a broadly and shallowly excised apex. Labium with the glossae about the same length but somewhat narrower than the paraglossae, apices more pointed than in *T. minor*, and armed with a tuft of setae. Outer margin of paraglossae slightly sinuous, so that the apex is more acute than in *T. minor*. Palpus three-segmented, first about half as long as second, which is a little shorter than third. Maxillae well developed, lacina terminating in a single truncate tooth, and a number of stout setae; galea much as in *T. minor*. Maxillary palpus five-segmented, extending about as far as apex of lacinia; first and second subequal, third twice as long, fourth a little longer than second, fifth about as long as third. Mandibles with a few rather blunt teeth.

Pronotum similar to *T. minor*, but more heavily marked. Lower anterior apical angle of femur not produced. Tibia with an additional narrow brown band on inner anterior surface, parallel to fringe. Abdomen cylindrical, brownish above, tergites one to nine with a whitish apical margin; sternites light yellowish-brown, with golden pubescence. Tenth tergite longer than eight and nine together, centre of its apical margin produced, obtuse, not produced in a finger as in *T. minor*. Anal gills whitish. Sub-anal plates much as in *minor*. Cerci long (10 mm)., slender, about sixty segments, carrying a dorsal fringe as in *minor*.

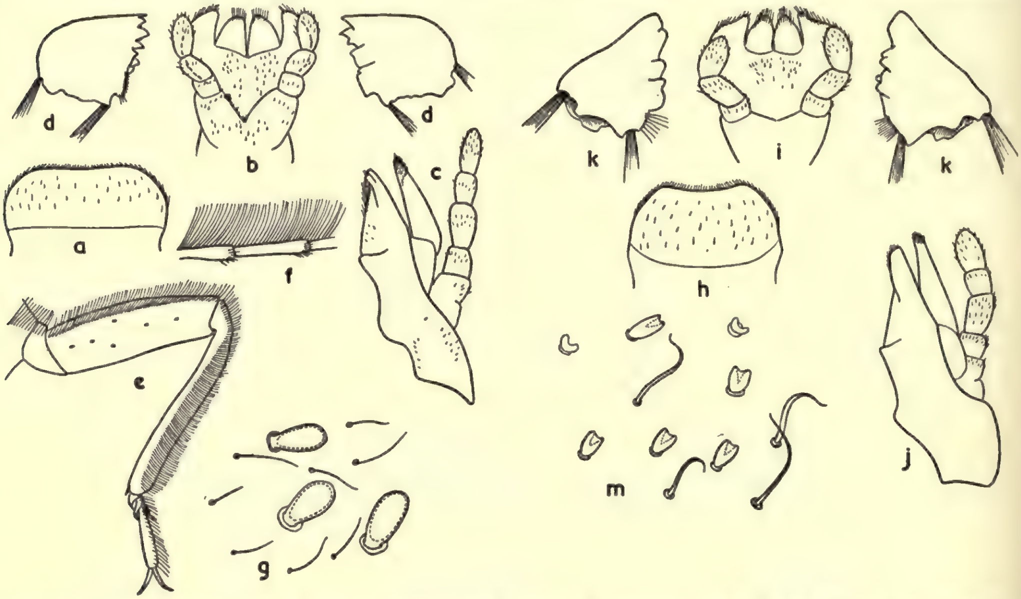


FIG. 32. *Trinotoperla* spp. Nymphal structure. *a–g*, *T. minor*; *h–m*, *T.* sp. No. 1. *a*, labrum; *b*, labium; *c*, maxilla; *d*, mandibles; *e*, leg; *f*, portion of cercus; *g*, vestiture; *h*, labrum; *i*, labium; *j*, maxilla; *k*, mandibles; *m*, vestiture.

TASMANIA: Scottsdale, Cuckoo Falls Creek, 31.vii.1931 (R. J. Tillyard).

Four male nymphs, two apparently last instar, and two with very rudimentary wing pads. Up to the time of writing I have not seen any adult *Trinotoperla* from Tasmania, but from wing-venation these nymphs undoubtedly belong to that genus. The presence of cross-veins in the anal fan suggests *Eunotoperla*, but the venation of the fore wing is different. The practice of describing new species of Plecoptera from the nymphs alone is undesirable, and in consequence I am giving these nymphs numbers instead of names. I have also seen single examples of two more species of *Trinotoperla* from the same locality, but as material is so scanty I propose to do nothing further with them at present.

Trinotoperla sp. No. 2

FIGS. 33, 34

Mature nymph: General colour light yellowish-brown, male about 9 mm., female about 12 mm. long; medium to rather stout build, legs long and sprawling; clothed throughout with short curved setae, which arise from globular tubercles: setae widened at their bases, apices very slender. Head flattened, only slightly wider than pronotum; antennae about as long, or a little longer than body, filiform, tapering, a small dorsal fringe at base.

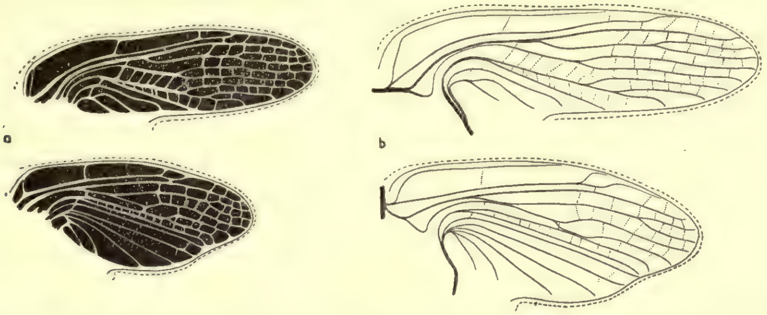


FIG. 33. *Trinotoperla* sp. No. 2. *a*, nymphal wing pads; *b*, tracheal venation.

Labrum bent downwards, concealed under the head, apex directed caudad; short and broad, apical margin slightly emarginate, angles rounded. Labium with the glossae slightly shorter and narrower than the paraglossae. Palpus short and stout, not reaching apex of paraglossae, apical segment about twice as long as basal, second rather shorter than third. Maxilla strong, lacinia with about three acute teeth at its apex, and a number of bristles. Galea tapering, rather hairy. Maxillary palpus rather short and stout, first segment half as long as second, which is two-thirds as long as third. Fourth as long as second, fifth as long as third. Mandibles strong, with numerous acute teeth.

Pronotum quadrate, side margins parallel or slightly convergent anteriorly, anterior and posterior margins gently rounded, angles pronounced; a slight median line and a strong transverse posterior furrow. Wing pads large, anterior elongate, posterior broader, yellowish-brown, venation indicated by rows of brownish setae, arising from globular bases. In the only large male nymph the tracheal venation is quite evident as well as the imaginal venation, and in the hind wing the fusions of Rs and M, and M3+4 and Cu1 are clearly shown, confirming Tillyard's study of

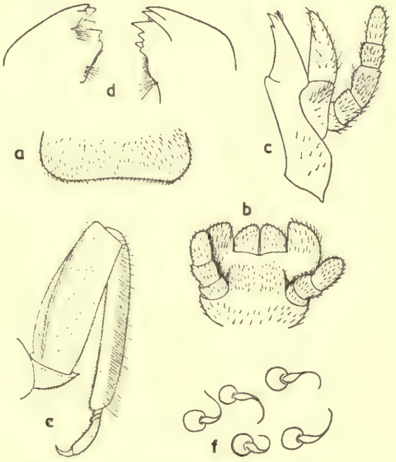


FIG. 34. *Trinotoperla* sp. No. 2. Nymphal structures. *a*, labrum; *b*, labium; *c*, maxilla; *d*, mandibles; *e*, leg; *f*, vestiture.

Dinotoperla. Cross-veins in the apical half of the wing dense, including several in the pterostigmatic area.

Legs rather long and sprawling, in the male giving a somewhat Ecdyonurid appearance. Trochanters, particularly of anterior legs, with an acute spur at lower apical angle. Femora strongly carinate dorsally, all legs with a dense dorsal fringe.

Abdomen cylindrical, in male shorter than hind femur, in female longer. In male, segments one to nine very short, tenth tergite as long as tergites three to nine, apical margin produced in an acute, somewhat raised point. Basal margins of tergites nine and ten each with a pair of stout finger-like apodemes. Cerci long, tapering, with at least thirty-six segments, bearing a dorsal fringe. Sub-anal plates moderately long, broad at base, tapering near apex, which is rounded. Anal gills pale mauve. In female, segments one to nine longer than in male, tenth tergite about as long as tergites seven to nine, apical margin evenly rounded. Apodemes of tergites nine and ten more noticeable. Cerci similar to male, sub-anal plates rather shorter and blunter.

AUSTRALIA: New South Wales, Bolaro, 22.xii.1935, 3 ♀; Rule's Point, 4,450 ft., 30.xii.1934, 1 ♂, 2 ♀ (R. J. Tillyard).

The rather sprawling appearance of the nymph, the backwardly deflected labrum, and the acute spine on the anterior trochanter separate this species from any other *Trinotoperla* nymph which I have seen.

Fam. NEMOURIDAE Klapálek 1909

This family, which occurs so abundantly in the Northern Hemisphere, is represented in the Southern by about eight genera, comprising at present comparatively few species. They differ to some extent from the typical Northern Nemouridae, particularly in the venation, the fore wing resembling more that of the family Leuctridae. They are nevertheless true Nemouridae, as in the hind wing the media is clearly forked and there are five veins on the anal fan. In the Leuctridae the media is apparently simple, Cu1 being apparently forked, and there are only three veins on the anal fan. It is probable that in the latter family the cross-vein from the media to the cubitus is the branch M3+4, which then fuses with Cu1 and subsequently diverges again to form the apparent fork of Cu1. In the hind wing, Rs and M are united at base, whereas in Leuctridae M arises from a cross-vein uniting Rs and Cu.

In view of the differences in venation, it seems desirable to place the Nemouridae of the Southern Hemisphere in a separate subfamily, characterized as follows:

NOTONEMOURINAE Ricker 1950[1]

Fore wing with Cu2 long, generally extending well into the apical half of the wing; cross-vein in the pterostigmatic area of both wings either absent or present. Hind wing with the media forking at or before the radio-medial cross-vein.

The subfamily will include the following genera:

Aphanicerca Tillyard	S. Africa.
Aphanicercella Tillyard	,,
Aphanicercopsis Barnard	,,

---

[1] See Appendix, p. 92.

Desmonemoura Tillyard	S. Africa
Neonemura Navás	Chile.
Notonemoura Tillyard	New Zealand.
Spaniocerca Tillyard	,, ,, Australia, Tasmania.
Spaniocercoides Kimmins	,, ,,
Udamocercia Enderlein	S. America, Tasmania.

Neonemura Navás is probably a synonym of *Udamocercia* Enderlein. It is described from a female, which possesses an ovipositor similar to that of *Udamocercia*. *Nemura pirioni* Navás, from Chile, should also be transferred to the Notonemourinae on the evidence of the long Cu2 figured in the fore wing; it is probably a *Udamocercia*.

The venation of the Nemouridae as a whole offers few characters of value for generic separation. It is comparatively simple, though not primitive in type, and tends to be variable in the position and number of the cross-veins. The males of the three species of *Spaniocerca* from Australia and Tasmania which I have examined, whilst obviously related to each other, differ somewhat in genitalic pattern from the New Zealand species; had the females shown similar affinities, it might have been desirable to separate generically the Australian and Tasmanian species from those occurring in New Zealand. Unfortunately the females differ in genitalic pattern not only from each other but also from *S. zelandica* Tillyard. Pending the acquisition of further material from these regions, it seems preferable to retain the Australian and Tasmanian forms in *Spaniocerca* and to extend its generic diagnosis to accommodate them, rather than to make a new genus based on male genitalic characters only.

The two remaining Nemourid species with which I am dealing in this paper are placed for convenience into the genus *Udamocercia* Enderlein. The male genitalia of one of the species (*U. albomacula*) are almost identical in pattern with those of two South American species of this genus. The other species shows a striking development of the supra-anal lobe, and the cerci are modified, but the general pattern is similar. Both species possess a cross-vein in the pterostigma of both wings (contrary to Enderlein's diagnosis), but this is probably variable as in both the South American species which I have examined it is present, although sometimes obscure. In view of the scanty material available—two males of different species, and a female which possibly belongs here—it seems unwise to erect a new genus for these Tasmanian species now.

SPANIOCERCA Tillyard

Spaniocerca Tillyard, 1923, *Trans. N.Z. Inst.* **54:** 216, fig.; Kimmins, 1938, *Ann. Mag. Nat. Hist.* (11) **2:** 572.

Type species: *Spaniocerca zelandica* Tillyard, 1923 (Monotypic genus).

Revised generic diagnosis

Sc arching up so as to meet or almost meet costa; cross-vein M—Cu in fore wing ending above on M3+4 at an angle to it; the latter vein generally curved as it leaves the transverse cord. Pterostigma in both wings without, or with only one cross-vein. Anal fan moderately narrow, somewhat excised at apex of fourth anal vein.

♂. Ninth tergite with apical margin generally produced in a pair of spines or lobes.

Ninth sternite more or less produced apically as a subgenital plate, with a median ventral lobe. Titillators of varying length, two-branched (New Zealand) or unbranched (Australia, Tasmania), arising near the apex of the ninth sternite. Cerci simple, sometimes angled. Supra-anal lobe in form of upturned hook.

♀. Margin of eighth sternite simple, or produced in a subgenital plate. Ninth sternite sometimes produced.

Spaniocerca tasmanica Tillyard

FIGS. 35–36

Spaniocerca tasmanica Tillyard, 1924, *Trans. Roy. Soc. S. Aust.* **48:** 195, fig. 3.

The holotype female has been reduced to two anterior and one posterior wings by the action of *Anthrenus*. The following descriptions have been made from a male and a female in fluid.

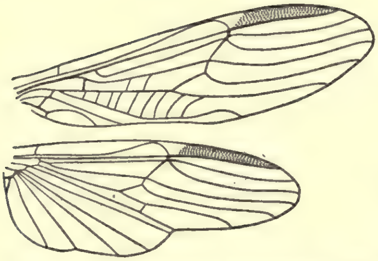


FIG. 35. *Spaniocerca tasmanica* Tillyard. Wings.

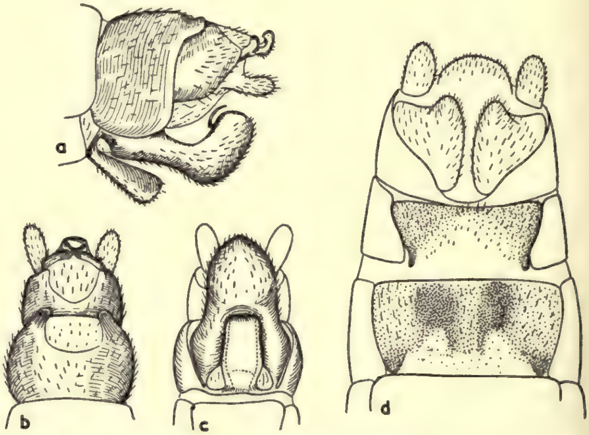


FIG. 36. *Spaniocerca tasmanica* Tillyard. Genitalia ♂, *a*, lateral; *b*, dorsal; *c*, ventral; *d*, genitalia ♀, ventral.

♂. Head dark brown, occiput orange-brown; antennae piceous, finely annulated with yellowish at sutures. Pronotum dark brown, quadrate, a little broader than long, anterior transverse furrow deep. Meso- and metanota shining piceous. Legs yellowish-brown to dark brown, femora with a conspicuous median ring of yellowish. Wings shining smoky-brownish, pterostigma darker, a few inconspicuous paler areas, especially distad of transverse cord and along cubitus of anterior wing. Venation brown; generally no cross-vein in pterostigma of either wing, or if present, indistinct; generally two medio-cubital cross-veins between M5 and the transverse cord.

Abdomen whitish except segments nine and ten, which are brown. Ninth tergite produced on either side of centre in a flattened rounded lobe; between the lobes is a transparent membranous area. Tenth tergite also with a membranous area at centre of apical margin, supra-anal lobe in form of a short broad hook, upcurved from a broad base. Cerci short, stout, lightly pigmented, clothed with short hairs. Ninth sternite with a strong ventral lobe, from the side dilating triangularly to a truncate apex; from beneath quadrate, slightly constricted at its base, apex faintly excised.

From the side, the sternite is produced, its apex bent sharply upward and dilated. From beneath it is slightly narrowed about midway, with an elliptical apex. From the upper apical margin arises a pair of small, scythe-like hooks, probably reduced titillators.

♀. Similar, larger. Wings with more definite hyaline areas. Abdomen whitish, seventh sternite, eighth and ninth segments brownish. Neither seventh nor eighth sternites produced, margins straight, both with hyaline areas at base. Sub-anal plates triangular, apices rounded, upper margins shallowly excised. Cerci short and stout.

Length of fore wing, ♂ 7 mm., ♀ 9·4 mm.

Length of hind wing, ♂ 5·3 mm., ♀ 8 mm.

The holotype was taken at Mt. Wellington, TASMANIA, 31.i.1917 (R. J. Tillyard). Other Tasmanian examples in the British Museum from Sheffield, 8.i.1917 (R. J. Tillyard), Hobart, 15.x.1916 (C. E. Cole), 4.xi.1916 (G. H. Hardy), Penstock Lagoon, 29.i.1933, and Gouldt County, 10.ii.1933 (R. J. Tillyard). From the mainland of AUSTRALIA I have seen examples from New South Wales, Mt. Kosciusko, 24.xi.1921, 3–9.xii.1921; South Australia, Cudlee Creek, 20.xi.1934 (R. J. Tillyard), and Adelaide.

Spaniocerca tillyardi sp.n.

FIG. 37

General appearance similar to *S. tasmanica*; there appear to be two forms of this species, one of which is smaller and paler than the other.

♂. Head dark brown, occiput a little paler; antennae piceous, with fine pale annulations at sutures. Pronotum dark brown, quadrate, a little broader than long, anterior margin somewhat convex, anterior transverse furrow deep. Meso- and metanota shining dark brown. Legs as in *tasmanica*. Wings rather narrower, shining smoky-brownish, with a hyaline area just beyond the transverse cord, and a larger one in the neighbourhood of Cu1. Venation dark brown, no cross-vein in pterostigma of either wing; one or two medio-cubital cross-veins between M5 and the transverse cord.

Abdominal segments pale or light brownish, apical margins whitish, segments eight to ten darker. Ninth tergite produced on either side in a flattened lobe, apices approaching one another calliper-wise. Between them the margin is excised and membranous. Tenth tergite also with a membranous area at the centre of its apical margin, giving the appearance of an excision. Supra-anal lobe broad and triangular at its base, a membranous area at its base separating two rounded hairy elevations. From the apex arises a slender hook, in side view with a rounded excision on dorsal surface near base. Cerci longer than in *tasmanica*, from the side angled upwards in the form of a foot. Ninth sternite long, more slender than in *tasmanica*, not dilated at its apex, which terminates in a pair of short incurving fingers. From its upper surface arises a pair of flattened titillators, curving upwards and basally, then downwards and diverging apically. These titillators are broad at their bases, apical two-thirds narrow and blade-like. Ventral lobe much narrower in ventral aspect, slightly constricted in its apical half. From the side, it is parallel-sided, apex truncate.

♀. Similar, except that abdominal segments one to seven are whitish. Eighth sternite slightly produced, centre of apical margin still further produced in a small, triangular lobe; this lobe is more pigmented than the remainder of the margin, and is connected to the main part of the segment by a narrow band of pigmentation. Ninth sternite strongly produced apically in an acute triangle, a narrow triangular membranous area at its centre from base to apex. In side view, this sternite resembles the valves of a short ovipositor. Cerci short, sub-anal plates subtriangular, apices rounded.

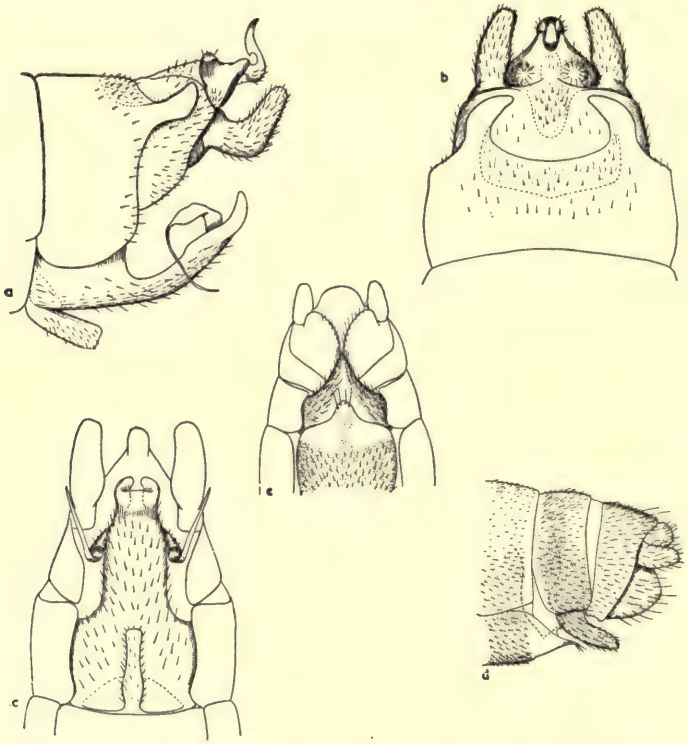


Fig. 37. *Spaniocerca tillyardi* sp.n. Genitalia ♂, *a*, lateral; *b*, dorsal; *c*, ventral; *d*, genitalia ♀, lateral; *e*, ventral.

Length of fore wing, ♂ 5·8–6·6 mm., ♀ 6·3–7 mm.

Length of hind wing, ♂ 4·9–5·8 mm., ♀ 5·2–6 mm.

Australia: F.C.T., Lee's Springs, xi.1932 (R. J. Tillyard).

Type male, paratype female in form of microscope preparations, remainder in 2 per cent. formaldehyde solution.

Spaniocerca bullata sp.n.

Fig. 38

♂ (in fluid). Head shining piceous, antennae piceous, finely annulated with yellowish at the sutures. Pronotum brown, quadrate, a little broader than long, angles rounded, anterior transverse furrow deep, its ends curving backward. Meso- and metanota shining piceous. Legs dark brown, tibiae with a yellowish ring in basal half, below the knee. Wings pale smoky-brownish (anterior the darker), pterostigma darker, and a darker area over the transverse cord. Venation brown; no cross-vein in pterostigma; one to three medio-cubital cross-veins between M5 and transverse cord.

Abdomen pale brownish, segments nine and ten darker. Ninth tergite not produced. Ninth sternite produced in a large subgenital plate, broad from beneath, sides sinuous, apex rounded. From the side it is rather narrow, apex roundly truncate, and from the upper margins towards the apex arise a pair of slender arms, curving tailward and inward. From behind, a membranous finger is seen between the incurving arms. Also towards the apex there arises from the upper surface a pair of flattened titillators, bent basally about midway, and in the type resting within the tenth tergite; in the paratypes these titillators are bent outwards at right angles to the line of the body. Ventral lobe short and deep from the side, rather narrow from beneath. Tenth tergite with a V-shaped excision at the centre of its apical margin. Supra-anal lobe trapezoidal at its base with four elevated knobs on its upper surface; the apex is produced upwards at right angles in a broad, rather thin lobe with a rounded apex. Cerci short, stout, slightly angled near the base in side view, tapering to a rounded apex. At the base is a small narrow sclerite.

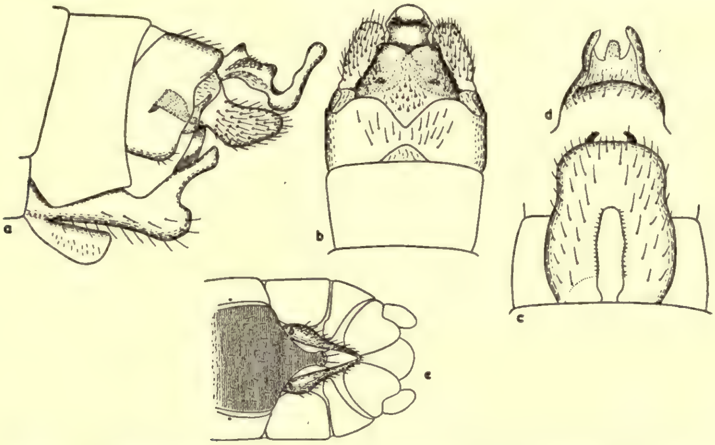


FIG. 38. *Spaniocerca bullata* sp.n. Genitalia ♂, *a*, lateral; *b*, dorsal; *c*, subgenital plate, ventral; *d*, apex of the same from behind; *e*, genitalia ♀, ventral.

♀. Similar to male, larger, wings with a faint indication of a cross-vein at base of pterostigma. Genitalia following the pattern of *S. tillyardi*. Eighth sternite more strongly produced at its centre in a slender, slightly clavate lobe. The whole sternite evenly pigmented. Ninth sternite triangularly produced, blade-like from the side, definitely narrower than the eighth sternite. Sub-anal plates broad, from beneath outer margin concave, apex rounded. Cerci short, somewhat ovate from beneath.

Length of fore wing, ♂ 8 mm., ♀ 9 mm.

TASMANIA: no other data (J. W. Evans), 3 ♂, 4 ♀.

The specific name *bullata* refers to the four knobs on the supra-anal lobe. Type male, paratype female in form of microscope preparations, remaining paratypes in 2 per cent. formaldehyde solution. The female is associated on general appearance and on similarity of genital structure with *S. tillyardi*, with which species the male shows more affinity than with *S. tasmanica*. The form of the supra-anal lobe and subgenital plate of the male distinguish it from *S. tillyardi*.

UDAMOCERCIA Enderlein

Udamocercia Enderlein, 1909, *Zool. Anz.* **34:** 418.
Type species: *Leuctra antarctica* Enderlein, 1905 (Monotypic genus).

Wings similar to *Spaniocerca*, but without excision at apex of fourth anal vein in the hind wing. Anal fan narrower. Cu2 in fore wing relatively longer.

♂. Ninth tergite not produced; ninth sternite produced, long, slender ventral lobe at base. Titillators slender, upcurved, arising from membrane below tenth tergite, not from apex of the ninth sternite. Supra-anal lobe either in the form of an upwardly directed hook arising from a broad base, or downwardly directed and bifurcate. Cerci one-segmented, short, quadrate, or bent inward.

♀. In the South American species the eighth sternite is produced in a long sword-like ovipositor. I have seen but one Tasmanian example which I believe to belong to this genus. In it the eighth sternite is produced and elevated in a short triangular subgenital plate, notched at its apex. The ninth sternite is strongly chitinized and its apical margin triangularly produced. From general appearance of the wings, this female appears closer to *U. albomacula* than to *U. bifasciata*, but as it bears no other data than Tasmania, I am not assigning it to either of these species.

Enderlein originally asssociated the type species with *Leuctra*, but it is more Nemourid than Leuctrid. It has five anal veins in the hind wing, whereas the Leuctridae have only three, and M3+4 is not partially fused with Cu1, as is the case with *Leuctra*, which thus has an apparent fork to Cu1, and an apparently unforked medius in the hind wing.

Udamocercia albomacula sp.n.

FIGS. 39, 40 *a–c*

♂ (dried). General colour piceous, shining. Head broader than pronotum; antennae slender, shorter than fore wing. Pronotum broader than long, broadest before the middle, side margins definitely angled at broadest part; a distinct, anterior transverse impressed line. Legs dull yellowish-brown, with darker markings at knees, base of femur, and apex of tibia. Wings light smoky-brown with paler areas at centre of pterostigma, distad of transverse cord, between branches of cubitus, and near base of fore wing. Venation brownish. Abdomen brownish. Ninth tergite not produced, sternite narrow, apical margin produced in a slender tongue, at least as long as sternite, curving upward from the side. Ventral process slender, pointed apically. Tenth tergite with an excision of its basal margin from above, apical margin produced, rounded, its centre curling downward, and clothed in a dense mat of short black setae. From beneath it arises the supra-anal lobe, whose base is a broad rounded plate. Its apical margin is extended upwards as a slender hook, on each side of which is a small rounded lobe. Titillators two, slender, upcurved, membranous on upper surfaces, very flexibly attached to the membrane below the tenth tergite. Cerci short, stout, quadrate, with a chitinous plate at base.

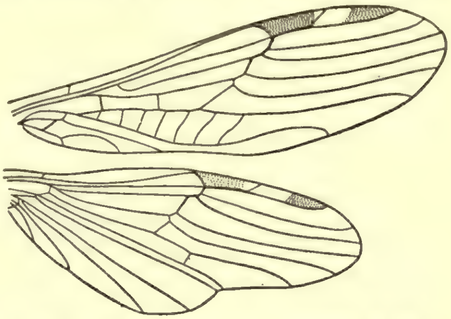


FIG. 39. *Udamocercia albomacula* sp.n. Wings.

♀ unknown.

Length of fore wing 5·8 mm., of hind wing 4·9 mm.

TASMANIA: Cradle Mountain, 16.i.1917, 1 ♂ (R. J. Tillyard).

Type pinned, with the abdomen mounted in balsam.

Udamocercia bifasciata sp.n.

FIG. 40 *d–f*

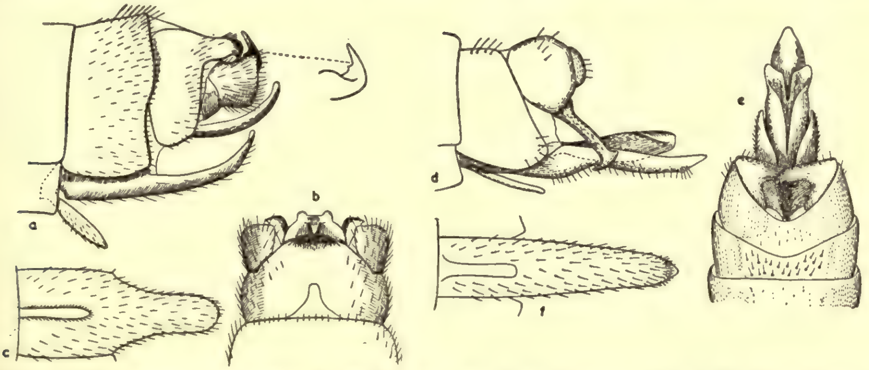


FIG. 40. *Udamocercia* spp.n. ♂ genitalia. *a–c*, *U. albomacula*; *d–f*, *U. bifasciata*. *a*, lateral; *b*, dorsal; *c*, subgenital plate, ventral; *d*, lateral; *e*, dorsal; *f*, subgenital plate, ventral.

♂ (in fluid). Head shining piceous, palpi and basal segments of antennae fuscous (remaining segments lacking in type); pronotum fuscous, slightly broader than long, anterior transverse furrow distinct; angles rounded, lateral margins slightly convex. Meso- and metanota fuscous. (Legs lacking in type.) Wings light smoky-brown, anterior darker than posterior, and with two distinct white transverse fasciae, the outer straight, at the level of the base of the pterostigma, the inner curved, concave side towards the apex of the wing, running from apex of Sc basad of transverse cord nearly to apex of Cu2. Venation brownish, a faint cross-vein at base of pterostigma in both wings. In posterior wing R4+5 separates from R2+3 beyond the transverse cord. Abdomen lightly chitinized, segments eight to ten brownish, but membranous dorsally. Ninth tergite rather narrow above but longer at its lateral margins. Ninth sternite produced in a long slender subgenital plate, acute at its apex, and at first glance resembling an ovipositor. Ventral lobe slender, about as long as lateral margins of ninth tergite. Attached to the membranous upper surface of the subgenital plate towards its base are a pair of elongate titillators, fused throughout most of their length, apex shallowly emarginate, with a deep narrow excision at its centre. Tenth tergite small, strongly chitinized at the sides, and bearing a pair of strong, inwardly hooked cerci whose bases only are visible from the side, appearing as small lobes. Supra-anal lobe directed obliquely downward, deeply forked in dorsal aspect, each branch from the side seen as a slender process with a dilated and hooked apex, placed on either side of the subgenital plate.

Length of fore wing, 5 mm.

TASMANIA: no other data, 1 ♂ (J. W. Evans).

Type in form of microscope preparation. At some future date it may be necessary to erect a new genus to contain this species, but for the present, in view of the scanty material available, it is proposed to place it in *Udamocercia*.

APPENDIX

This paper, though virtually completed in 1941, could not be published under war conditions and was revised in 1948, following the receipt of more material. Further delays in publication ensued, and since it went to press I have received from Dr. W. E. Ricker (April 1951) a reprint of his paper 'Some Evolutionary Trends in Plecoptera' (1950, *Proc. Indiana Acad. Sci.* **59:** 197–209) in which he proposes a new subfamily name NOTONEMOURINAE (type genus *Notonemoura* Tillyard) and includes also the genera *Spaniocerca* Tillyard and *Spaniocercoides* Kimmins. My conception of this subfamily is wider, embracing the genera enumerated on pp. 84–85. Nevertheless I have adopted Dr. Ricker's subfamily name, but allowed my original definition to stand. D. E. K.

INDEX

Synonyms printed in italics.

albomaculata, Udamocercia 90
antarctica, Leuctra 90
antarctica, Udamocercia 90
Antarctoperla 46
Aphanicerca 84
Aphanicercella 84
Aphanicercopsis 84
Aucklandobius 47
australica, Leptoperla 51
australica, Paranotoperla 51
australis, Trinotoperla 76
Austroperla 46

beroë, Leptoperla 49
bifasciata, Udamocercia 91
brevipennis, Dinotoperla 67
bullata, Spaniocerca 88

carpenteri, Dinotoperla 66

Desmonemoura 85
Dinotoperla 47, 62
,, sp. nymph 74

Eunotoperla 47
Eusthenia 46
evansi, Dinotoperla 70
exigua, Leptoperla 53

fasciata, Dinotoperla 73
fontana, Dinotoperla 64
fusca, Dinotoperla 71

GRIPOPTERYGIDAE 46
  Diagnosis 46
  Key to genera 47
Gripopteryx 46

irrorata, Trinotoperla 75

kershawi, Eunotoperla 48

Leptoperla 47, 48
,, spp. nymphs 59–62
LEPTOPERLIDAE 46
Leptoperlini 46
LEUCTRIDAE 84

Megaleptoperla 47
minor, Trinotoperla 78
,, ,, nymph 79

NEMOURIDAE 84
Neonemura 85
Nesoperla 47
nigricoxa, Dinotoperla 72
nigrifrons, Leptoperla 58
nivata, Trinotoperla 78
Notonemoura 85
Notonemourinae 92
Notoperla 46
Nymphs
  Dinotoperla 74
  Leptoperla 59–62
  Trinotoperla 79–84

opposita, Chloroperla 63
opposita, Dinotoperla 63
opposita, Leptoperla 63
opposita, Perla 63

Paragripopteryx 46
Paranotoperla 46, 48
pirioni, Nemura 85

reticulata, Leptoperla 57
rugosa, Leptoperla 56

serricauda, Dinotoperla 62
Spaniocerca 85
Spaniocercoides 85
Stenoperla 46

tasmanica, Leptoperla 51
tasmanica, Spaniocerca 86
thwaitesi, Dinotoperla 68
tillyardi, Spaniocerca 87
Trinotoperla 47
,, spp. nymphs 79–84

Udamocercia 85, 90
uniformis, Dinotoperla 69

varia, Leptoperla 54

zelandica, Spaniocerca 85
Zelandobius 47
Zelandoperla 47

PRESENTED

PRINTED IN
GREAT BRITAIN
AT THE
UNIVERSITY PRESS
OXFORD
BY
CHARLES BATEY
PRINTER
TO THE
UNIVERSITY

17 DEC 1951

SPHECIDAE AND POMPILIDAE (HYMENOPTERA)

COLLECTED BY MR. K. M. GUICHARD IN WEST AFRICA AND ETHIOPIA

G. ARNOLD

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 2 No. 3
LONDON : 1951

SPHECIDAE AND POMPILIDAE (HYMENOPTERA) COLLECTED BY MR. K. M. GUICHARD IN WEST AFRICA AND ETHIOPIA

1941–1948

BY
G. ARNOLD
National Museum of Southern Rhodesia
Bulawayo

Pp. 95–183; Pls. 4–5; 65 Text-figures

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 2 No. 3
LONDON : 1951

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in 1949, is issued in five series, corresponding to the Departments of the Museum.*

Parts appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, No. 3, of the Entomological series.

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued November 1951 *Price Fifteen shillings*

SPHECIDAE AND POMPILIDAE (HYMENOPTERA) COLLECTED BY MR. K. M. GUICHARD IN WEST AFRICA AND ETHIOPIA, 1941–1948

By G. ARNOLD

PART I. SPHECIDAE

THIS paper is based on a collection of nearly 700 specimens which Mr. R. B. Benson of the British Museum has submitted to me for study. It is of considerable interest, since it is derived from regions from which there have been few new records within at least the last fifty years. The great majority of the species from West Africa known up to the date of Dalla Torre's *Catalogus Hymenopterorum*, 1897, were made known chiefly by F. Smith and F. F. Kohl, and after that date by R. E. Turner. The proportion of new species is considerable, especially of the Cercerinae. On the other hand, the tribes Miscophini, Psenini, and Pemphredonini, of which the members are small or very small, are barely represented.

In the following list of species I have given only the original reference, which in many cases applies to only one sex. For descriptions of the other sex, if known, the reader should refer to my monograph of the African Sphecidae published in the *Annals of the Transvaal Museum*, **9–14**, 1922–1931, and to several papers published in the *Occasional Papers* of the National Museum of Southern Rhodesia.

Types of new species are in the British Museum.

The least magnification required to resolve the sculpture with a stereoscopic binocular microscope is indicated in brackets, e.g. (40 diameters).

Subfamily TRYPOXYLONINAE

Pison xanthopus Brullé

1833, *Ann. Soc. Ent. Fr.* **2**: 408.

Kpeve, Gold Coast, June 1942, 1 ♂.

Pison allonymum Schulz

1906, *Spolia Hymen.*: 213.

Haramaia, Ethiopia, June 1948, 1 ♀.

Pison montanum Cameron

1910, *Sjöstedt's Kilimandjaro-Meru Exped.* **8**: 289.

Dilla (Sidamo) Ethiopia, June 1948, 2 ♂♂.

Trypoxylon viduum sp. n.

(FIGS. 1, 1*a–c*)

♂. 11 mm. long. Black. Wings hyaline, slightly smoky beyond the cells. Clypeus and face up to the scutate area, and the temples with silvery, the occiput with short and black pubescence. Thorax with the usual whitish and erect pubescence, nowhere dense. Clypeus twice as wide in front as long, the anterior margin feebly convex. Facial shield entire, slightly longer than wide across the lateral angles, from which is emitted a carina extending over the inner half of the ocular sinuses. The shield is closely punctured, the punctures largest at the sides, the interspaces about as wide as the punctures. Behind the scutate area but not reaching the posterior ocelli, the puncturation is larger and deeper at the sides. Second joint of the flagellum twice as long as wide, as long as the third, the apical joint acute, four times longer than wide at the base and nearly as long as the four proceeding joints united. Interocular distance on the vertex equal to the length of the first three joints of the flagellum plus half of the fourth. Posterior ocelli as far from the eyes as from each other. Pronotum and mesonotum nitidulous, the former with sparse punctures and rounded shoulders, the mesonotum sparsely punctured in the middle but more closely at the sides, the punctures about as large as those on the facial shield. Mesopleura shining, a little more finely punctured than the mesonotum. (Scutellum and metanotum obscured by the pin.) The U-shaped area of the epinotum obliquely rugose over the basal third, the median groove wide and transversely costate, the rest of the area finely rugose, the sides of the epinotal dorsum and the declivity very coarsely transversely rugose and with anastomoses. The sides of the epinotum shining, vertically and not closely striate. Petiole slender, fully six and a half times longer than wide

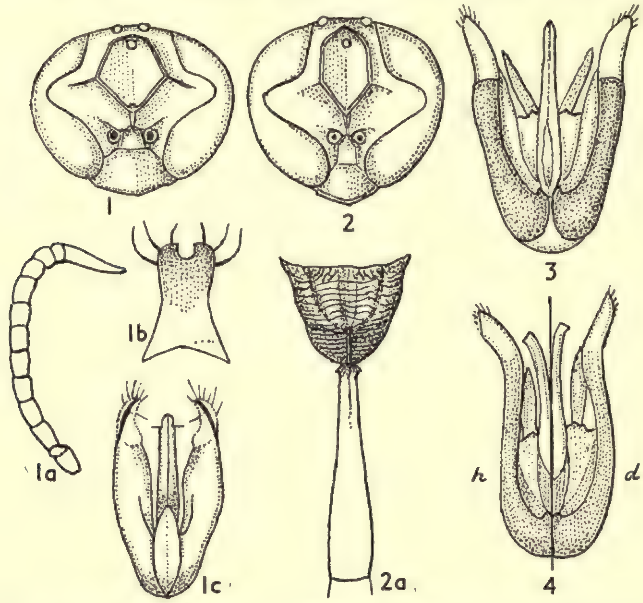


FIG. 1. *Trypoxylon viduum* ♂, head, ×15. FIG. 1*a*. *Trypoxylon viduum* ♂, antenna, ×15. FIG. 1*b*. *Trypoxylon viduum* ♂, 8th sternite, ×27. FIG. 1*c*. *Trypoxylon viduum* ♂, genitalia, ×27. FIG. 2. *Trypoxylon acutangulum* ♀, head, ×15. FIG. 2*a*. *Trypoxylon acutangulum* ♀, epinotum and petiole, ×15. FIG. 3. *Philanthus ugandicus* ♂, genitalia, ×21. FIG. 4. *Philanthus histrio* ♂, genitalia, *h*; *Philanthus histrio*, race *distinctus*, *d*, ×24.

across the node, and as long as the second, third, and half the fourth tergites united. The second tergite is as long as the third, and not quite twice as long as wide behind. Second abscissa of the radius twice as long as the first. The eighth sternite resembles that of *T. abditum* Arnold, but differs in having three stout bristles emitted from each arm; the genitalia are like those of *T. cognatum* Arnold but the outer paramera are narrower.

Jowaha, N. of Debra Sina, 6,000 ft., Ethiopia, 1 ♂.

This could be the ♂ of *T. latiscutatum* Arnold, but I hesitate to ascribe it to that species in the absence of females from the same locality.

Trypoxylon acutangulum sp. n.

(FIGS. 2, 2*a*)

♀. 9 mm. long. Black. Tarsi dark brown, the apical joint of the hind pair ochreous. Wings hyaline, the veins black, the costa brownish-yellow at the base. Clypeus and lower half of the face with silvery pubescence, the thorax with sparse whitish pubescence. Facial shield and ocular sinuses dull, closely and very finely punctured (30 diameters), the vertex in front of and between the ocelli less closely punctured and with a row of larger punctures behind the shield. Anterior margin of the clypeus convex. Facial shield entire, narrow, three-fourths longer than wide across the lateral angles, the apical angle acute. A faint trace of a carina is emitted from the angles into the ocular sinuses. Interocular distance on the vertex equal to the length of the first two joints of the flagellum plus two-thirds of the third joint. Posterior ocelli almost contiguous with the eyes. Second joint of the flagellum as long as the third. Shoulders of the pronotum rounded. Mesonotum and scutellum shining, very finely punctured, the interspaces fully twice as wide as the punctures on the sides of the mesonotum, wider on the disk. Mesopleura more finely punctured and more sparsely than the mesonotum. Median area of the epinotal dorsum U-shaped, one-fourth wider at the base than long, shallowly grooved down the middle, reticulate-rugose at the base, transversely and finely rugose elsewhere, the rugae extending over the lateral areas of the dorsum. Declivity transversely rugose and finely punctured, and with a deep median longitudinal impression. There is a deep pit at the brow of the declivity. Sides of the epinotum shining, finely transversely striate. Petiole four and a half times longer than wide behind, as long as the second tergite plus two-thirds of the third. Second abscissa of the radius two and a half times longer than the first.

Niamey, French West Africa, August 1944, 1 ♀.

Remotely related to *T. kohli* Arnold, but smaller, with a narrower facial shield and a shorter petiole.

Subfamily PHILANTHINAE

Philanthus coarctatus Spinola

1838, *Ann. Soc. Ent. Fr.* **7**: 486.

Ufdem, Ethiopia, August 1944, 1 ♂.

Philanthus rubidus Arnold

P. abyssinicus Arnold, 1932, *Occ. Pap. Rhod. Mus.* **1**: 7.
P. rubidus Arnold, 1946, *Occ. Pap. Nat. Mus. S. Rhod.* **12**: 82.

River Errer, near Harar, Ethiopia, May 1948, 1 ♂.

Philanthus ugandicus Magretti

1908, *Bull. Mus. Hist. Nat., Paris,* **14**: 188.

Adis Ababa, Dessie, and Zuquala (9,000 ft.), Ethiopia, 7 ♂♂.

Philanthus histrio distinctus subsp. n.

(FIG. 4*d*)

P. histrio Fabricius, 1804, *Syst. Piez.*: 301.

♂. 12 mm. long. Black, the occiput slightly rufescent. The pale markings on the head and abdomen are similar to those of *histrio* i. sp. but the colour is creamy white instead of yellow, the clypeus has a rectangular black macula in the middle of the anterior margin, and the maculae on the second tergite are larger and not triangular, but nearly round.

The thorax is entirely black. Fore legs brown, middle and hind femora black, their tibiae and tarsi brownish, the former with the apical third whitish on the outside, and also the first four tarsal joints. Puncturation on the vertex behind the ocelli larger and wider apart than in the type of the species; the puncturation of the mesonotum also a little coarser, otherwise the sculpture is like that of the type of the species. The second joint of the flagellum is thinner, being nearly four times longer than the third. The genitalia differ slightly, the apical third of the outer paramera being narrower and more acute at the apex. (Fig. 4*h*, genitalia of *histrio* i. sp.)

Debra Sina, Ethiopia, November 1945.

Philanthus loefflingi Dahlbom, var. **meneliki** Arnold

1925, *Ann. Transv. Mus.* **11**: 150.

Bishoftu, Ethiopia, June 1948, 1 ♂.

Philanthus dichrous dolosus Kohl, var. **abyssinicus** Arnold

1925, *Ann. Transv. Mus.* **11**: 162.

Goré, Ethiopia, February 1948, 1 ♂, 2 ♀♀.

In these specimens the thorax is entirely black, as are also the middle and hind legs.

Philanthus fuscipennis consimilis Kohl

1891, *Ann. naturh. Hofmus. Wien,* **6**: 349.

Bishoftu and Jowaha, Ethiopia, 3 ♂♂. These three are a slight variety in which the hind tibiae are yellow. In one of the specimens from Jowaha the scutellum and postscutellum are also yellow.

Subfamily CERCERINAE

In Plates 4 and 5 the male genitalia of the majority of the species described hereunder are illustrated. For figures of other species included in the Guichard collection and which are also found in the southern half of the continent the reader should refer to my paper on *Cerceris* published in the *Journal of the Entomological Society of Southern Africa*, **5**, 1942. For the sections into which I have separated the females, the chapter on the genus in my monograph of the African Sphecidae, in the *Annals of the Transvaal Museum*, **14**, part 2, should be consulted. These sections are solely for the purpose of facilitating the identification of the species and are not natural, as can be seen by a comparison of the genitalia of the corresponding males. For example, the genitalia of species in which the females have such distinctive characters as a porrect clypeus lamina, sections B and C, or a median tubercle, section E, can differ considerably.

I am unable to recognize the validity of the subgenus *Apiraptrix* Shestakov, which is based on the presence of a basal platform on the second sternite. In some species there is a more or less distinct median carina on that segment which is sometimes flattened cephalad. The basal platform appears to have arisen by a gradual reduction of the carina, but the platform is by no means always distinctly defined. In fact an examination of a fair proportion of the species shows that there is a gradation from a raised area with well-defined margins to one which is barely recognizable. In one case, *C. varicincta* Cameron, this variability is exhibited within the species.

Cerceris longiuscula sp. n.

(FIGS. 5, 5*a*; PL. 4, FIG. 1)

♂. 14 mm. long. Black. Apical margin of the first tergite and all of the following tergite pale burnt umber, the second and third paler than the rest. Sternites 2–7 dull yellow, stained with brown over their apical halves. Apical third of the fore and middle tibiae and all the tarsi, pale reddish-brown. The following parts are creamy white: clypeus excepting the black anterior third, sides of the face up to the level of the antennal sockets, lower half of the frontal triangle, a small round spot at the top of the temples, a small transverse spot on the pronotal shoulders, a triangular spot on the mesopleura below the tegulae, and a transverse spot on each side of the scutellum.

Wings pale fuscous. Clypeus dull, very finely rugulose, and with a few shallow punctures superimposed; the lateral sclerites with sparse, decumbent, and yellow pubescence. The rest of the head dull, with a microscopic and dense puncturation, on which is superimposed a larger and deeper one which becomes finer dorsad, the interspaces a little wider than the punctures. Between the ocellar area and the antennal sockets there are also a few longitudinal rugae. The frontal carina is high and acute. Thorax dull. Anterior face of the pronotum almost smooth, the dorsal face finely and very sparsely punctured. The puncturation of the mesonotum and scutellum a little larger and closer than that of the face, that of the mesopleura much larger and closer, reticulate punctate; the metapleura are costate except over the middle third. The epinotum, excepting the triangular area and the somewhat shining middle lower half of the declivity, has a puncturation about twice as large as that of the mesonotum, but less close; the triangular area is obliquely costate, eight costae on each side. Tergites microscopically reticulate and dull, with a very sparse, small, and shallow puncturation on the second to sixth tergites, the first tergite with a sparse and large one.

Pygidial area coarsely punctured, rectangular, twice as long as wide, the apical margin straight. Sternites shining, shallowly punctured, the sixth with a small tooth on each side near the apical margin. Median area of the clypeus long, about half as long again as wide, produced well beyond the lateral sclerites, shallowly grooved in the middle of the apical half, the apical margin feebly concave. Inner orbits feebly divergent below, the interocular distance across the clypeus very little greater than across the vertex. Posterior ocelli twice as far from the eyes as from each other; the interocular distance on the vertex equal to the length of the first four joints of the flagellum. The second joint is twice as long as wide at the apex and one-fourth longer than the third, the apical joint twice as long as wide at the base and obliquely truncate.

Dorsum of the pronotum not short, as long as the third joint of the flagellum. Mesonotum wide, four-fifths wider than long. First tergite nearly twice as wide behind as long, the second two-thirds longer than the first and three-fourths wider behind than long. Posterior tibiae with six serrations.

Kpeve, Gold Coast, June 1942, 1 ♂.

Not related to any other African species known to me. The outer paramera of the genitalia are distinctive, being produced into an acute tooth on the inside not far from the apex.

Cerceris pallida Arnold, var. **lutulenta** var. n.

C. pallida Arnold, 1935, *Bull. Soc. Sci. Nat. Maroc*, **15**: 5.

♀. 15 mm. long. This is a variety in which the colour of the head and thorax is dull ochreous, the mesothorax pale ferruginous, with the margins of the mesopleura and the middle of the epinotal declivity blackish. The tergites are ochreous, the first four black at the extreme base and apex. Legs reddish-yellow.

Boghé, Mauritania, September 1943, 1 ♀.

Cerceris moggionis sp. n.

(FIGS. 6, 6*a* and 6*b*; PL. 4, FIG. 2)

♂. 13 mm. long. A streak on the upper half of the median area of the clypeus and the posterior margins of the lateral sclerites straw-yellow, the rest of the clypeus brown. Sides of the face, frontal triangle, and the frontal carina also pale yellow, the vertex reddish-brown at the sides, the rest of the head black. Antennae ferruginous, the last three joints black. Pronotum dark ferruginous, blackish in the middle and at the lower margins of the sides, the tegulae ferruginous, the rest of the thorax black. Abdomen pale ferruginous or yellowish-red, the apical half of the first tergite pale yellow, a median triangular area on the second sternite and the basal halves of the third to sixth sternites, blackish. Legs pale ferruginous. A small elongate spot on the outside of the apical half of the anterior femora, the apical two-thirds of the underside of the middle and hind femora, the upper side of the hind coxae and the upper side of the middle and hind tibiae, pale yellow.

Wings pale fuscous, with a violaceous tint, darkest on the costal margin and radial cell. Head with a decumbent silvery pubescence, less dense on the vertex than elsewhere. Epinotum with exserted, fairly long and white pilosity. Abdomen with short, sparse, and yellowish pubescence. Clypeus dull and smooth, the rest of the head and the dorsum of the pronotum reticulate-punctate, the punctures about one-third as wide as the anterior ocellus. Anterior face of the pronotum shallowly punctured, the sides transversely rugose. Metapleura transversely costate above and below, the rest of the thorax strongly reticulate-punctate, the punctures on the mesothorax a little larger and deeper than those on the head. Median area of the epinotum with six large transverse costae. Tergites 1–5 not quite dull, with fairly large punctures, the interspaces for the greater part twice as wide as the punctures, the sixth finely punctured and dull, the pygidial area nearly twice as long as wide, the lateral margins parallel over the basal half, convex outwardly on the apical half, the apical margin convex. Sternites 1–6 shining, shallowly and sparsely punctured, the sixth with a yellow fimbria on its hind margin and a triangular tooth on each side. Median area of the clypeus oval, feebly convex, nearly half as long again as wide, the apical margin with three large and rounded teeth. Inner orbits parallel. Vertex wide, the interocular distance there equal to the length of the first five joints of the flagellum. Posterior ocelli twice as far from the eyes as from each other. Second joint of the flagellum a little more than twice as long as wide, two-fifths longer than the third, the apical joint half as long again as wide, transversely truncate at the apex. Shoulders

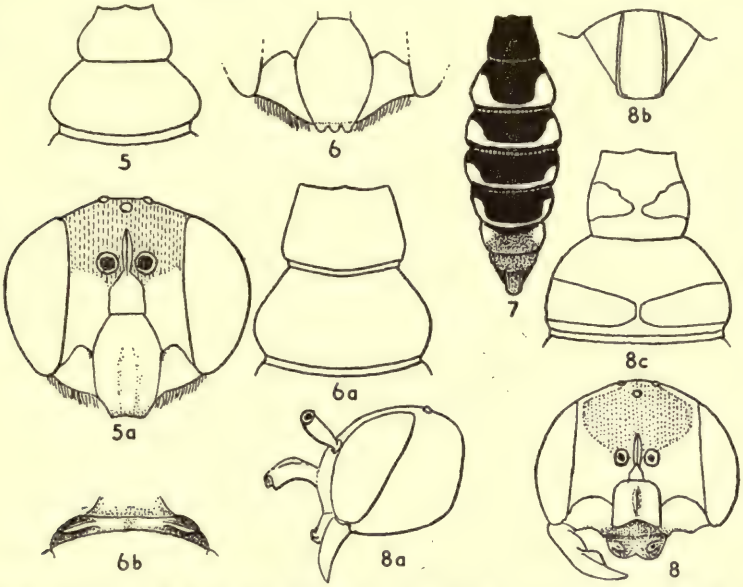


FIG. 5. *Cerceris guichardi* ♂, first two tergites, × 6. Fig. 5*a*. *Cerceris guichardi* ♂, head, × 10. FIG. 6. *Cerceris moggionis* ♂, clypeus, × 10. FIG. 6*a*. *Cerceris moggionis* ♂, first two tergites, × 10. FIG. 7. *Cerceris insignita* ♂, abdomen, × 6 (stippled parts ferruginous). FIG. 8. *Cerceris flavonasuta* ♀, head, × 10. FIG. 8*a*. *Cerceris flavonasuta* ♀, first two tergites, × 10. FIG. 8*b*. *Cerceris flavonasuta* ♀, pygidium, × 10. 8*c*. *Cerceris flavonasuta* ♀, first two tergites, × 10.

of the pronotum angular, raised to form a subcarinate tubercle. Mesopleura with a small tooth below. Scutellum depressed lengthwise in the middle. Epinotal dorsum short, about as long as the scutellum. First tergite three-eighths wider behind than long, second tergite seven-ninths wider than long. Hind tibiae with five serrations.

Moggio, Ethiopia, April 1948, 1 ♂.

Not related to any other Ethiopian species. The tuberculate pronotal shoulders and the shape of the outer paramera of the genitalia are distinctive. The outer paramera have on the inside, a little behind the middle of their length, a lamelliform fimbriated lobe, which can be seen only when those parts are widely splayed out.

Cerceris insignita sp. n.

(Fig. 7; Pl. 4, fig. 3)

♂. 11 mm. long. Black. Antennae, occiput, posterior half of the temples, pronotum, tegulae, scutellum, metanotum, sixth and seventh abdominal segments, and the legs, ferruginous. Mandibles ferruginous, last three joints of the flagellum blackish above, median area of the clypeus, sides of the face, frontal triangle, and carina, yellowish-white; the lateral sclerites of the clypeus pale brown and with a fine yellowish pubescence, the moustache brown. Tergites 2–5 with a narrow pre-apical pale yellow band which is abruptly dilated laterad, the dilatation almost reaching the base, the sixth with a yellow spot on each side. Sternites fusco-ferruginous. Wings hyaline, the veins brown, the pterostigma ochreous, the apical third of the forewing pale fuscous. Clypeus and yellow areas of the face dull, shallowly, finely and sparsely punctured. The rest of the head, and the thorax, reticulate-punctate and dull, the punctures on the vertex about one-third as wide as the anterior ocelli, the punctures on the mesonotum and scutellum a little larger, and largest on the mesopleura. Triangular area of the epinotum slightly shining, closely and transversely rugose, the middle third of the epinotal declivity shining and almost smooth. Tergites 1–6 dull, sparsely punctured, the punctures as large as those on the vertex. Pygidial area shining, sparsely punctured, nearly parallel-sided but a little wider over the posterior half, the apical margin convex. Sternites smooth and shining, the sixth with a curved tooth on each side below which there is a bundle of ferruginous hairs; seventh sternite arcuately emarginate at the apex, the lateral margins raised or carinate.

Median area of the clypeus convex, suboval, half as long again as wide, the apical margin tridentate. Inner orbits parallel. Posterior ocelli twice as far from the eyes as from each other. Interocular distance on the vertex equal to the length of the first five joints of the flagellum. The second joint is twice as long as wide, one-fourth longer than the third, the apical joint truncate. Dorsum of the pronotum short, as long as the first joint of the flagellum, the shoulders subangular. First tergite as long as wide behind, the second two-thirds wider behind than long. Hind tibiae with five serrations.

Moggio, Ethiopia, April 1948, 1 ♂.

The colour pattern of the tergites is unlike that of any other Ethiopian species. Although so different in colour from *C. moggionis*, it is allied to that species, but the genitalia are different. The outer paramera are elongate triangular over the distal third and acute at the apex. Another specimen, also from Moggio, represents a variety, *opulenta* var. n., which differs from the type as follows:

♂. 12 mm. long. Occiput and temples black, the latter with a small ferruginous macula on top. The yellow areas on the tergites are more extensive, so much so that on the second tergite the black area is reduced to a transverse band at the base and a small triangular pre-apical macula, its base caudad. On the third tergite the black covers only the middle third of the segment, a little more on the fourth and fifth, but on the latter the black merges caudad into ferruginous. The first tergite is a little broader in proportion to its length, and the sculpture on the head and thorax is also a little shallower.

Cerceris rufiscutis Cameron, var. **decolorata** Arnold

C. rufiscutis Cameron, 1910, *Sjöstedt's Kilimandjaro-Meru Exped.* **8:** 278.
Arnold, 1931, *Ann. Transv. Mus.* **14:** 182.

Haramaia, April 1948, 1 ♀, 1 ♂; Lake Bishoftu, Ethiopia, August 1946, 1 ♀; Moggio, April 1945, 1 ♂; Lekempti, Ethiopia, June 1946, 1 ♂.

Cerceris flavonasuta sp. n.

(FIGS. 8, 8*a–c*; PL. 4, FIG. 9)

♀. 12·5 mm. long. Head ferruginous, with a large macula extending from the antennal sockets to a little distance behind the ocellar area, and the anterior half of the temples black. Lamina of the clypeus pale yellow, its apical margin blackish; the median area below it black. Frontal carina pale yellow, mandibles fusco-ferruginous, antennae ferruginous, the fifth and following joints of the flagellum fuscous above. Thorax black, the metanotum pale yellow. Tergites 1–4 and the basal half of the fifth black, the first to third with pre-apical yellow bands, narrowly interrupted in the middle and moderately dilated laterad, the fourth with a very thin pre-apical yellow band; the sternites 1–4 black, the second and third with a large yellow macula on each side, the fifth and the whole of the apical segment ferruginous. Antennae, apices of the femora, tibiae, and tarsi ferruginous. The hind coxae with a pyriform yellow macula on the upper side. Wings hyaline, tinged with dull yellow, the pterostigma ochreous, the veins brown, the tegulae ferruginous.

Labrum wider than long, with a large tubercle on each side. Median area of the clypeus below the lamina smooth and shining. The lamina is free to its base, as long as wide, convex transversely and strongly so lengthwise, a little wider in front than behind, shining, sparsely punctured and broadly carinate lengthwise in the middle, the apical margin shallowly excised. Lateral sclerites of the clypeus shining and sparsely punctured.

Head dull and reticulate-punctate, finely on the face, more strongly on the vertex, with the meshes emphasized longitudinally, and more finely and closely on the occiput and upper part of the temples; the underside of the head is longitudinally rugose and fairly strongly punctured in between.

Thorax dull, pronotum closely and finely punctured, mesonotum and scutellum longitudinally and finely rugose, punctate, the punctures on the middle part of the mesonotum largest and not so large as on the upper part of the face. Metanotum finely and sparsely punctured.

Mesopleura and epinotum closely rugulose-punctulate, with a shallow larger punccturation superimposed. Triangular area of the epinotum closely and obliquely rugulose, finely punctured between the rugae. First tergite shining, with sparse and large punctures. The second to fifth closely and finely punctured over the basal half, more sparsely with larger punctures apically.

Pygidial area widened towards the straight apical margin, and half as long again as wide there. Sternites shining, shallowly and sparsely punctured, the sixth deeply and narrowly excised. Mandibles with a broad rounded tooth at the middle of the inner margin. Interocular distance on the vertex equal to the length of the first six joints of the flagellum, the second joint five-eighths longer than the third. Ocelli half as far again from the eyes as from each other. Temples wide, at their widest clearly wider than the eyes. Pronotal collar short, the shoulders rounded. Mesopleura with a feeble denticle below. First tergite as long as wide, the second three-fourths wider than long. Posterior tibiae with seven spiniferous serrations.

♂. 9·5 mm. long. Clypeus, frontal triangle and carina and lower two-thirds of the face, excepting a black streak extending from the antennal sockets to the clypeus, pale chrome yellow; the mandibles ochreous, black at the apex, the rest of the head black.

Pronotal collar with a transverse yellow band, narrowly interrupted in the middle. Apical margin of the fifth abdominal segment, and the whole of the sixth and seventh ferruginous. Posterior coxae and trochanters pale yellow on the underside. Eighth to eleventh joints of the flagellum infuscated on the upperside. Otherwise coloured like the ♀.

The sculpture is everywhere a good deal more coarse than in the ♀. Yellow areas of the face and the clypeus dull, shallowly and sparsely punctured, the interspaces about three times wider than the punctures. Thorax dull, the abdomen nearly so. Pronotal collar sparsely and shallowly punctured. Mesonotum and scutellum clearly longitudinally and finely rugose with a shallow and not close puncturation in between the rugae. Mesopleura coarsely reticulate-punctate, the punctures about half as wide as one of the posterior ocelli. Triangular area of the epinotum closely, obliquely, and finely rugose, grooved down the middle; the rest of the epinotum with a large and deep puncturation. The abdominal segments have a microscopic and close fundamental puncturation on which is superimposed a larger one, the punctures as large as those on the epinotum, but more widely spaced, the interspaces being for the greater part two and a half times wider than the punctures. Pygidial area slightly widened towards the transverse apex, half as long again as wide, the sides slightly convex. Median area of the clypeus slightly flattened, a little longer than wide, the apex tridentate. Interocular distance on the vertex equal to the length of the first six joints of the flagellum. Apical joint of the flagellum curved, twice as long as wide, the apex transversely truncate. First tergite nearly one-fourth longer than wide. Posterior tibiae with six serrations.

Aselle, Ethiopia, July 1947, 1 ♀; Lekempti, Ethiopia, May 1946, 2 ♂♂.

This species belongs to the small section B in my key to the species (1931, *Ann.*

Transv. Mus. **14:** 137), which also includes *C. andersoni* Turner. It differs from that species and the other four species by the shape of the clypeal lamina and pygidial area, and from *proteles* Brauns, *bicolor* Smith (Pl. 4, fig. 4), and *pictiventris* Gerstaecker by the colour of the abdomen.

Cerceris fulviventris Guérin

(PL. 4, FIG. 4)

1844, *Icon. règne anim.* **7:** 444.
C. bicolor Smith, 1856, *Cat. Hymen. B.M.*: 447.
Guiglia, 1948, *Ann. Mus. Stor. Nat. Genova,* **63:** 187.

Kaolack, August 1943, 1 ♂; Kaffrine, August 1943, 1 ♂ and 1 ♀.

Guiglia's redescription of *fulviventris* Guérin, based on the type, appears to me sufficient evidence that *bicolor* Smith should sink in synonymy. The colour of the ♂ in regard to the yellow markings is variable. In the ♂ from Kaolack all the tergites have a short yellow streak on each side at the hind margin. It should also be noted that whereas in the ♀ the epinotal triangle is transversely costate, in the ♂♂ that area is coarsely reticulate-rugose. The ♂ is easily recognizable by the large semi-elliptical lobe, directed ventrad, on the inner inferior margin of the outer paramera of the genitalia.

Cerceris severini Kohl

1913, *Rev. zool. afr.* **3:** 207.
Brauns, 1926, *Ann. Transv. Mus.* **11:** 289.

Diaforabe, French Sudan, August 1944, 1 ♂, 1 ♀; Abbai Gorge, Ethiopia, October 1945, 1 ♀; Niamey, Niger Colony, August 1944, 1 ♀; Tillembeya, River Niger, French Sudan, September 1944, 4 ♂♂. The specimen from Abbai Gorge has the first tergite, excepting the apical margin, black, and third to fifth tergite infuscated in the middle.

It should be observed that there is an error in Dr. Brauns's translation of the original description, which runs 'The fourth (i.e. third) abscissa of the radius is one and a half times longer than the first three (i.e. two) united, which are very short.' Kohl says: 'Der Abschnitt der Radialader, welcher die 3 Cubitalzelle vorne begrenzt, ist sehr viel kürzer als das folgende Stück, welches mehr als 1½ Mal so lang als wie jenes ist.'

Cerceris zavattarii Guiglia

(PL. 4, FIG. 5)

1939, *R. Accad. Ital. Miss. biol. Borana,* **3** (2): 58.

I ascribe to this species, known to me only from the description, a specimen to which I refrain from giving a varietal name, since it differs only in minor details and greater size from one of the paratypes mentioned by Guiglia.

♂. 14 mm. long. The dark areas of the head and thorax are black, without any ferruginous parts. The vertex has two small yellow spots behind the ocelli. The median maculae on the tergites are shorter, not reaching the apical margin, and also more semicircular, that on the first black and on the following fusco-ferruginous. The interocular distance on the vertex is equal to a little more than the length of the first four joints of the flagellum. The second joint of the flagellum is fairly slender, or two and three-fifths longer than wide at the apex, the apical joint is short and obliquely truncate. The dense exserted and yellow pilosity on the sternites, including even the eighth, is a distinctive character.

Bishoftu, 7,000 ft., Ethiopia, May 1948.

This species bears a strong resemblance to *C. nugax* Arnold and like it has the sternites densely pilose. It can be distinguished, however, by the very different sculpture of the epinotal triangle, by the more slender antennae, the narrower first tergite, and the shape of the outer paramera of the genitalia, which are more acute at the apex and strongly dentate on the inner margin.

Cerceris rhodesiae Brauns

(PL. 4, FIG. 6)

1929, *Ann. Transv. Mus.* **11**: 330.
Arnold, 1942, *J. Ent. Soc. S. Afr.* **5**: 20.

I reduced this species to the rank of a subspecies of *C. monocera* Kohl, but on re-examination, and a more careful comparison of the genitalia, find that the latter organs are not identical as I believed. Since the stipites or outer paramera are in most cases curved, it is necessary in comparing them to arrange them in exactly the same plane. As a result, it can be seen that though the genitalia are very similar, in those of *rhodesiae* the dilatation or lobe on the inner margin of the outer paramera is less abrupt, and the distal portion beyond it is longer and rounder at the apex. Also the differences in the puncturation and in the colour pattern are too great to be considered merely subspecific. Furthermore, another character which I overlooked is to be seen in the radial cell. In *rhodesiae* it is truncate at the apex, whereas in *monocera* the apex is bluntly angular and ends on the costal margin. For these reasons *rhodesiae* must be restored to specific rank. A specimen in this collection represents a subspecies, *rhodesiae haramaiae* subsp. nov.

♂. 11 mm. long. In colour this differs from the species in having pale yellow bands, dilated laterad, on the second to sixth tergites, an elongate macula of the same colour on each side of the epinotal declivity and the scutellum entirely black. The upper sides of the femora are dark brown, almost black on the hind pair. The dorsum of the thorax is moderately shining, the mesonotum more strongly rugose lengthwise, and the punctures between the rugae deeper. The puncturation of the epinotum is larger and deeper and less close, the interspaces smooth and fully as wide as the punctures, whereas in *rhodesiae* i. sp. the interspaces form raised meshes.

The median area of the clypeus is shorter and does not project so far beyond the lateral sclerites, it is one-fourth longer than wide, in *rhodesiae* very nearly one-half longer than wide. The ocelli are one and three-quarter times farther from the eyes than from each other, in *rhodesiae* one and a half. The first tergite is wider, or as wide as long, and in *rhodesiae* one-fourth longer than wide. The genitalia barely differ, the outer paramera being a little less widely dilated anteriorly and slightly rounded at the apex.

Haramaia, Ethiopia, May 1948, 1 ♂.

Cerceris campsomeroides sp. n.

(PL. 4, FIG. 7)

♂. 14 mm. long. Black. Clypeus, excepting a wide anterior margin, sides of face, frontal triangle and carina, wide apical bands moderately dilated laterad on the second, third and fourth tergites and an apical band covering only the middle third on the fifth tergite, chrome yellow. Fore and middle femora black, their apical fourth, like the tibiae and tarsi dull yellow, the hind legs also of that colour, but the femora more or less stained reddish on the apical half. Apical joint of the flagellum and ochreous below. Wing hyaline, the veins reddish ochreous, the pterostigma pale yellow, the apical margin of both wings faintly fuscous.

Head and thorax with a long, erect, yellowish-grey pilosity, the abdomen with a shorter, oblique and sparser one, on the sternites somewhat denser on the apical margins. Yellow area on the head dull, longitudinally rugulose and finely and fairly closely punctured. The upper part of the face, excepting a small smooth area below the anterior ocellus, closely punctured and rugulose, the vertex and upper part of the temples less closely, with larger punctures which are about one-third as wide as one of the posterior ocelli, the interspaces a little wider than the punctures. Lower half of the temples strigose lenghtwise and closely punctured, the punctures smaller than on the vertex. Sides of the pronotum coarsely wrinkled, the mesopleura obliquely costate. The rest of the thorax strongly punctured, the largest punctures, on the scutellum and metanotum, are half as wide as one of the posterior ocelli, the interspaces wider than the punctures. Those on the pro- and mesonotum slightly smaller, and a little closer, on the epinotum equally large but closer, or almost reticulate-punctate. The triangular area on epinotal dorsum is dull, obliquely rugose and punctured, its lateral margins not impressed and therefore rather indistinct. First tergite with a puncturation like that of the epinotum, the second to fifth more strongly punctured on the apical than on the basal half, the interspaces a little wider than the punctures; the sixth and seventh tergites sparsely and coarsely punctured, the pygidial area a little narrower at the base than at the apex and fully twice as long as wide at the base, the apical margin straight. Tumid areas of the sternites with a shallow and fairly large puncturation. The whole body fairly dull. Median area of the clypeus fairly flat, one-seventh longer than wide, the apical margin strongly tridentate. Temples a little wider than the eyes. Posterior ocelli very little farther from the eyes than from each other, the interocular distance on the vertex equal to the length of the first five joints of the flagellum. The apical joint of the flagellum curved, excavated below, the two preceding joints also concave below and feebly carinate lengthwise. Dorsum of the pronotum sloping cephalad, as long in the middle as the third joint of the flagellum, the shoulders rounded. First tergite one-fourth wider behind than long, the second a little shorter than the first and fully twice as wide behind as long. Hind tibiae with seven spiniferous serrations. Second abscissa of the radius two-thirds longer than the first.

Accra, Gold Coast, 1941, 1 ♂.

Not closely related to any other Ethiopian species. In the colour and narrow abdomen this insect has a superficial resemblance to the males of some species of the Scoliid genus *Campsomeris*, e.g. *C. clotho* Saussure.

C. iniqua Kohl

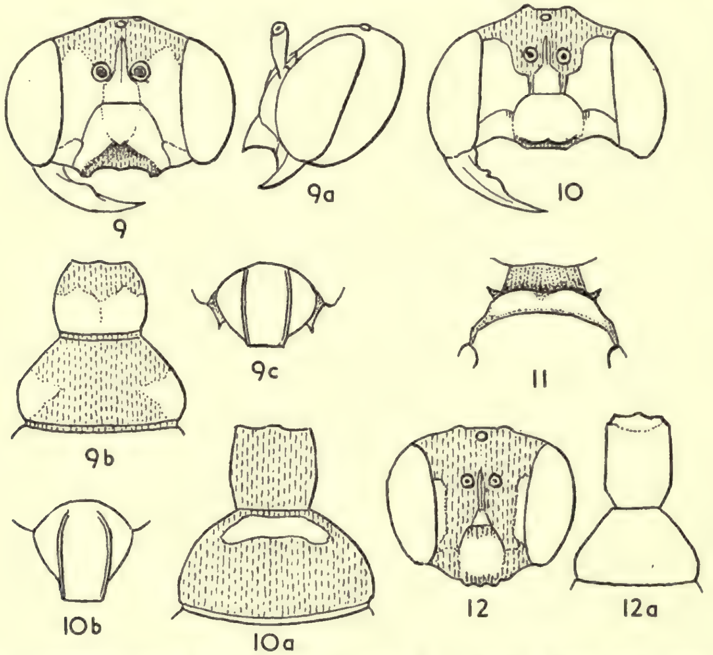
1894, *Ann. naturh. Hofmus. Wien*, **9**: 288.

Lekempti, 6,500 ft., Ethiopia, May 1946, 1 ♂.

Cerceris nobilitata walegae subsp. n.

C. nobilitata Cameron, 1905, *Trans. S. Afr. Phil. Soc.* **15**: 216.

♀. 10·5 mm. long. Larger than *nobilitata*, and differing from that as follows: Dorsum of the pronotum raised on each side into a transverse pale yellow torus, similar to that in *C. osiris* Arnold but larger. Metanotum pale yellow, hind margin of mesopleura, the epinotum excepting the middle, and the first tergite and sternite and the second sternite, castaneous red. Second tergite black, the macula at the base yellow, not interrupted in the middle and larger. The apical band on the third tergite and the apical macula on the fifth pale ochreous, instead of yellowish-white, and larger. The puncturation of the abdomen is closer, the interspaces on the second to fifth tergites being, for the greater part, narrower than the punctures (wider in the type of the species). The first tergite is widest behind the middle, instead of at the



FIGS. 9 and 9*a*. *Cerceris faceta* ♀, head, × 12. FIG. 9*b*. *Cerceris faceta*, first two tergites, × 12. FIG. 9*c*. *Cerceris faceta*, pygidium, × 12. FIG. 10. *Cerceris electra* ♀, head, × 12. FIG. 10*a*. *Cerceris electra*, first two tergites, × 12. FIG. 11. *Cerceris maia* ♂, pronotum, × 12. FIG. 12. *Cerceris alcyone* ♂, head, × 12. FIG. 12*a*. *Cerceris alcyone*, first two tergites, × 12.

middle. The fore and middle femora are stained with black above, and the hind femora are castaneous red. Otherwise like the type of the species.

Gambeila, 700 ft., in the territory of the Walega and Nuer tribes, Ethiopia, February, 1948, 1 ♀.

The yellowish parts of the head have been discoloured to reddish-yellow by cyanide fumes.

In the presence of the tori on the pronotal dorsum this race resembles *C. osiris*, which is closely allied to *nobilitata*.

Cerceris faceta sp. n.

(FIGS. 9, 9*a–c*; PL. 4, FIG. 8)

♀. 9 mm. long. Black. The following parts are bright lemon-yellow: mandibles excepting the apex, clypeus excepting the median apical margin and the underside of the median cone, frontal carina, scapes, sides of the face, a small spot behind each eye, pronotal collar, tegulae, a round macula on the mesopleura below the wing-base, a round macula on each side of the scutellum, the metanotum, an ovoid macula on the sides of the epinotum, a band on the first tergite covering nearly the apical half, a transverse apical macula on each side of the second tergite, a wide apical band on the third, slightly dilated laterad, a much narrower one on the fourth, the apical half of the fifth, more or less triangular lateral maculae on the second, third, and fourth sternites, and the legs. The hind femora on the upper side, and the hind tibiae on the underside, streaked with black. The flagellum brownish-yellow above, ochreous below, the first two joints blackish. Wings hyaline, the forewing faintly fuscous at the apex, the pterostigma reddish-brown. Clypeus, face, and temples and mesopleura with fairly dense, whitish decumbent pubescence, elsewhere the pubescence is scanty. Yellow areas of the clypeus and face dull, not very closely punctured. Metanotum finely and sparsely punctured, metapleura obliquely rugose. Triangular area of the epinotum smooth and shining, grooved down the middle. The rest of the body is deeply and closely punctured. Second to fourth tergites are reticulate-punctate with punctures half as wide as one of the posterior ocelli, a little smaller but less close on the thorax and fifth tergite, smallest on the face and vertex which are reticulate-punctate. Pygidial area nearly twice as long as wide, the sides feebly convex, the apical margin straight, dull, coarsely punctured except over the apical third, which is rugulose. Sternites sparsely and coarsely punctured on the tumid areas. Mandibles with a low and wide tooth on the inner margin. Median area of the clypeus inflected in the anterior third, its anterior margin with a triangular tooth on each side; the basal two-thirds of the median area raised ventrad and ending in a short acute cone. Inner orbits feebly divergent above and below. Posterior ocelli half as far again from the eyes as from each other. Vertex wide, the interocular distance there equal to the length of the first seven joints of the flagellum. Pronotal dorsum convex transversely and lengthwise, in the middle as long as the second joint of the flagellum.

First tergite a little wider behind than long, the second as long as the first and twice as wide as long. Fifth sternite with an acute tooth on each side near the apical margin. Posterior tibiae with five spiniferous serrations.

♂. 7·5 mm. long. Apical half of the sixth tergite yellow, the second to fifth sternites with small yellow maculae on each side; hind femora and tibiae yellowish-brown on the upper side; otherwise the colour is like that of the ♀. Puncturation also as in the ♀.

Median area of the clypeus hexagonal, a little longer than wide, the apical margin tridentate. Apical joint of the flagellum two-fifths longer than wide, not emarginate on the inside, very little attenuated towards the rounded apex. The anterior inferior angles of the pronotum subdentate. Epimeron of the mesopleura swollen, clearly visible from the dorsal aspect. First tergite as long as wide, widest in the middle. Otherwise like the ♀.

Fatick, Senegal, August 1943, 1 ♀, 1 ♂.

Related to *C. rhodesiae* Brauns, from which it differs by the smaller size, the smooth triangular area of the epinotum, the puncturation, and in the ♂ also in the apical joint of the flagellum.

Cerceris nugax Arnold

(PL. 5, FIG. 17)

1931, *Ann. Transv. Mus.* **14:** 176.

Tillembeya, River Niger, French Sudan, August 1944, 2 ♂♂.

Fatick and Kaolack, Senegal, August 1943, 3 ♂♂.

The specimens from Senegal differ from the type form in having the median triangular black area of the tergites wider.

A re-examination of the paratype from Dahalak (Dahleck) Island, Red Sea, indicates that it should be considered a distinct race, not only on account of its larger size, but also on account of the sculpture of the epinotal triangle and the shape of the outer paramera of the genitalia. The epinotal triangle is not arcuately and transversely costate all over as in the type and in the West African specimens listed above, but is obliquely costate, having about twelve costae divergent caudad from the base and four or five arcuate costae in the apical angle. The outer paramera are much blunter at the apex.

This race may be known as *insularis* (Pl. 5, fig. 16).

Cerceris yungvei Cameron

(PL. 5, FIG. 18)

1910, *Sjöstedts Kilimandjaro-Meru Exped.* **8:** 273.

Ethiopia, Bishoftu, 1 ♂, 1 ♀; Moggio, 2 ♂♂; Akaki, 1 ♀, 1948; Aselle, 1 ♂.

Cerceris mazimba Brauns

1926, *Ann. Trans. Mus.* **11:** 295.
Arnold, 1942, *J. Ent. Soc. S. Afr.* **5:** 9.

Tillembeya, River Niger, French Sudan, August 1944, 1 ♀, 3 ♂.

In the ♂, 9 mm. long, the yellow markings on the abdomen are larger than in the type, but the genitalia do not differ.

Cerceris spinicaudata Cameron

1905, *Transv. S. Afr. Phil. Soc.* **15**: 216.

Accra, Gold Coast, 2 ♀♀, August 1941; Labadi, Gold Coast, 1 ♂, March; Kaffrine, Senegal, 1 ♂, August 1943; Moggio, Ethiopia, 1 ♂, June, 1946

Cerceris electra sp. n.

(FIGS. 10, 10*a* and *b*)

♀. 8·5 mm. long. Black. The following parts are yellowish-white: mandibles excepting the black apex, clypeus excepting the black anterior margin of the median area, sides of the face, frontal triangle and carina, upper side of the scapes, the outer thirds of the pronotal collar, the outer half of the tegulae, the metanotum, a broad transverse macula at the base of the second tergite, transverse apical bands on the third and fifth tergites, that of the third dilated laterad, and a large triangular macula on each side of the third sternite. Flagellum dark brown above, ochreous below. Fore and middle femora black above and at the base below, the underside yellowish-white, the hind femora with a spot of the same colour on the underside at the apex, the tibiae and tarsi pale yellow, the hind tibiae brownish above, the tarsal joints pale fuscous apically. Wings hyaline, the apex of the forewing fuscous, the pterostigma and veins brown. Clypeus and whitish areas of the face with a white and decumbent pubescence, the thorax and abdomen with sparse, short, and grey pubescence.

Clypeus and pale areas of the face dull, shallowly, finely and sparsely punctured, the rest of the head with punctures about one-third as wide as the anterior ocellus, the interspaces hardly wider than the punctures, except on the temples where they are a little wider.

Mesopleura coarsely reticulate-punctate and dull, the metapleura transversely striato-rugose, the triangular area of the epinotum shining, impunctate, and grooved down the middle. The rest of the thorax and the first five tergites moderately shining and with a strong puncturation. The punctures are about half as wide as the anterior ocellus, separated on the mesonotum and scutellum by interspaces wider than the punctures, and as wide on the tergites. Mesonotum impunctate. Tumid areas of the sternites less closely and more shallowly punctured than the tergites. The ventral margins of the first tergite are raised into a tubercle caudad, and the second sternite is feebly carinate lengthwise over the basal half. Pygidial area barrel-shaped, reticulate-rugose, nearly half as long again as wide, the apical margin straight. Mandibles with two small teeth on the inner margin. Median area of the clypeus fairly flat, a little wider than long, the anterior margin slightly inflected, the preapical margin forms two very short, wide, and convex lobes extending as far as the apical margin. Posterior ocelli a little farther from the eyes than from each other. Interocular distance on the vertex equal to the length of the first six joints of the flagellum plus half of the seventh. Second joint of the flagellum twice as long as wide. Anterior coxae produced outwardly in front, but not so much as in *C. placida* Arnold. First tergite about as long as wide, the sides feebly convex. Posterior tibiae with six spiniferous serrations.

Labadi, Gold Coast, March 1941, 1 ♀.

Allied to *C. placida* from which it differs by the colour of the scutellum and tergites, the sparser puncturation of the thorax, the lamina of the pre-apical margin of the clypeus, and the narrower first tergite.

Cerceris maia sp. n.

(Fig. 11; Pl. 5, fig. 10)

♂. 8 mm. long. Black. The following parts are pale yellow: clypeus excepting the black anterior margin, lower half of the face, a spot on the tegulae, apical bands on the second, third, fourth, and fifth tergites, that of the second dilated laterad, lateral maculae on the second to fourth sternites. The apical margin of the sternites, excepting the first, testaceous. Scapes yellow below, the flagellum ferruginous, paler below than above, the last four joints fusco-ferruginous above. Tarsi of the fore and middle legs reddish-yellow, the basal joint pale yellow except at the apex, the tibiae and trochanters ferruginous, darker above, the tibiae with a narrow reddish streak below. Trochanters and basal half of the hind femora pale yellow, the apical half black, the hind tibiae fusco-ferruginous, with a dorsal yellowish-white streak on the apical half, the hind tarsi reddish-yellow.

Wings smoky hyaline, the forewing beyond the cells and including the radial cell, pale fuscous, the pterostigma and veins dark brown. Head, dorsum of the thorax, first tergite, and sternites with a sparse, erect, and whitish pubescence. Clypeus and yellow areas of the face shining, strongly and closely punctured. Metapleura transversely costate, triangular area of the epinotum shining and smooth, feebly grooved down the middle; the rest of the body, excepting the basal halves of the sternites, coarsely reticulate-punctate, the punctures half as wide as the anterior ocellus, except on the head where they are a little smaller. Median area of the clypeus a trifle longer than wide, the anterior margin tridentate. Interocular distance on the vertex equal to the length of the first five joints of the flagellum plus two-thirds of the sixth. Posterior ocelli nearly half as far again from the eyes as from each other. Second joint of the flagellum one and a half times longer than wide, the apical third nearly twice as long as wide at the base, moderately curved and obliquely truncate. Antero-ventral corners of the pronotum produced into acute triangular teeth, which are clearly visible when the insect is viewed from above.

Pronotal collar in the middle as long as the second joint of the flagellum. First tergite widened caudad, the sides convex, one-sixth wider behind than long, and as long as the second. Pygidial area half as long again as wide, the sides feebly convex, the apex rectilinear. Posterior tibiae with five serrations. Anterior coxae conically produced outwards, as in *C. placita* Arnold.

Moggio, Ethiopia, April 1948, 1 ♂.

Not related to any other Ethiopian species, and easily distinguished by the teeth of the pronotum.

Not to be confused with *C. inconspicua* Arnold, in which it is the prosternum which is dentate on each side.

Cerceris alcyone sp. n.

(FIGS. 12, 12*a*; PL. 5, FIG. 11)

♂. 8 mm. long. Black. The following parts chrome yellow: the median area of the clypeus excepting the apical margin and extreme base, a narrow streak on each side of the face margining the eyes, frontal triangle and carina, an apical band slightly dilated laterad on the third tergite and on the third sternite, a very thin apical line on the fifth tergite (a brown one on the sixth), the apical half below of the hind coxae, and the hind trochanters. Mandibles ferruginous, black at the base and apex. Antennae dark brown, the first seven joints of the flagellum ferruginous below. Tegulae ferruginous. Fore legs pale ferruginous, the femora darker above. Middle femora and tibiae brownish above, red below. The tarsi brown excepting the basal joint, which is yellow. Hind legs brownish-red. Wings hyaline, the radial cell and anterior margin beyond it dark brown. Sternites nitidulous, the rest of the body dull. Clypeus and face not closely punctured, the interspaces about twice as wide as the punctures. Vertex and temples reticulate-punctate, the punctures one-fourth as wide as the anterior ocellus. Posterior margin of the sides of the pronotum transversely costate, the metapleura finely and transversely rugose, the triangular area of the epinotum transversely and arcuately rugose and grooved down the middle; the rest of the thorax coarsely reticulate-punctate, the punctures half as wide as the anterior ocellus. The puncturation of the tergites is as large as that of the thorax, but not quite so close, the interspaces being about half as wide as the punctures. The punctures on the tumid areas of the sternites are a little smaller than on the tergites. Median area of the clypeus feebly convex, one-third longer than wide, the apical margin distinctly tridentate. Interocular distance on the vertex equal to the length of the first seven joints of the flagellum. The second joint is twice as long as wide, and the apical two-fifths longer than wide at the base, and subconical. Posterior ocelli slightly farther from the eyes than from each other. First tergite one-fourth longer than wide, narrower at the apex than at the base. Pygidial area about half as long again as wide, the apex transverse, the lateral margins feebly convex. Posterior tibiae with five serrations.

Moggio, Ethiopia, April 1948, 1 ♂.

This species resembles *C. macalanga* Brauns in the colour of the face and clypeus, but is not related. It is more closely related to *C. spinicaudata* Cameron, from which it differs by the colour pattern, closer puncturation, the rugose triangular area of the epinotum and the genitalia.

Cerceris merope sp. n.

(FIGS. 13, 13*a*, and 13*b*; PL. 5, FIG. 12)

♀. 8·5 mm. long. Black. The following parts pale yellow: mandibles excepting the apex, clypeus excepting a narrow apical black margin, sides of the face, more narrowly above than below, upper side of the scapes, the outer thirds of the pronotal collar, the tegulae, metanotum, a transverse basal macula on the second tergite, an apical band very narrow mesad but reaching the base laterad on the third tergite, the tumid half of the third sternite, and an apical band on the fifth tergite dilated laterad, the fore and middle tibiae and underside of the femora, the posterior tibiae excepting an apical infuscation on the underside, the fore metatarsus, and the middle hind metatarsi excepting the extreme apex. The rest of the tarsal joints ochreous on the fore and middle legs, blackish on the hind legs.

Clypeus and yellow areas of the face shallowly and not very closely punctured. Vertex reticulate-punctate, the punctures one-third as wide as one of the ocelli; temples closely rugoso-punctate. Pronotal dorsum sparsely and not coarsely punctured, the anterior face a little more closely, the sides rugulose and shallowly punctured. Puncturation of the mesonotum, scutellum, and epinotum excepting the sides larger than that of the vertex, the interspaces on the mesonotum half as wide as the punctures, and fully as wide on the epinotum. Mesopleura coarsely reticulate-punctate, metapleura coriaceous, triangular area of the epinotum shining, grooved down the middle, very shallowly transversely rugose.

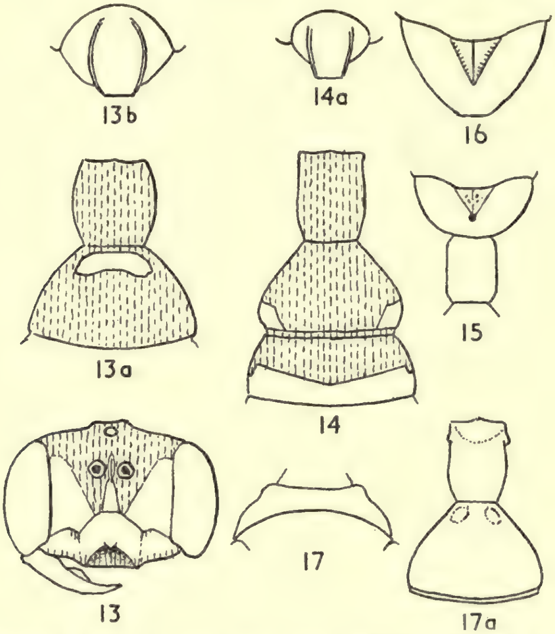


FIG. 13. *Cerceris merope* ♀, head, × 12. FIG. 13*a*. *Cerceris merope* first two tergites, × 12. FIG. 13*b*. *Cerceris merope* pygidium, × 12. FIG. 14. *Cerceris sterope* ♂, first three tergites, × 12. FIG. 14*a*. *Cerceris sterope*, pygidium, × 15. FIG. 15. *Cerceris celaeno* ♂, epinotum and first tergite, × 12. FIG. 16. *Cerceris macalanga* ♂, epinotum and first tergite, × 12. FIG. 17. *Cerceris taygete* ♂, pronotum, × 13. FIG. 17*a*. *Cerceris taygete*, first two tergites, × 12.

Puncturation of the tergites 1–5 as large as on the epinotum, fairly close but not reticulate-punctate. Pygidial area barrel-shaped, closely rugose, two-thirds longer than wide, the apical margin straight. First and second sternites carinate lengthwise medially, the tumid areas punctured like the tergites. Mandibles with a low broad tooth on the inner margin. Median area of the clypeus as wide as long, its anterior two-fifths inflected, the inflection not extending to the lateral angles, its upper margin arcuate and slightly tuberculate in the middle. Inner orbits feebly divergent below. Second joint of the flagellum twice as long as wide, one-third longer than the third joint.

Posterior ocelli about one-fourth farther from the eyes than from each other. Interocular distance on the vertex equal to a little more than the length of the first seven joints of the flagellum. Dorsum of the pronotum as long in the middle as the first joint of the flagellum, the shoulders rounded. Anterior coxae produced outwardly into a blunt cone. Triangular area of the epinotum one-fourth longer than wide at the base. First tergite as long as wide, widest in the middle, the sides convex, as long as the second, the latter four-fifths wider behind than long. Posterior tibiae with five serrations.

♂. 8·5 mm. long. Hind tibiae without the apical fuscous streak on the inside, the hind metatarsus pale yellow, the remaining joints brownish-yellow. The punctuation everywhere coarser than in the ♀, especially on the pronotal dorsum, the arcuate and transverse rugae on the epinotal triangle more distinct than in the ♀. The median longitudinal carina on the first sternite does not reach the apical margin, that on the second almost obsolete. Pygidial area wider at the base than at the transverse apex, the sides straight, very little longer than wide at the base. The yellow maculae on the pronotal dorsum smaller than in the ♀, covering only the outer fifths. Median area of the clypeus one-fourth longer than wide. Second joint of the flagellum twice as long as wide at the apex, barely longer than the third, the apical joint slightly longer than the third, and slightly longer than wide at the base, obliquely truncate. Otherwise like the ♀.

Accra, Gold Coast, September 1941, 1 ♀; July, 1 ♂.

Allied to *C. placida* Arnold from which it differs by the colour, shape of the first tergite, the sculptured triangular area of the epinotum, and in the ♀ also in the shape of the clypeus.

Cerceris sterope sp. n.

(FIGS. 14, 14*a*; PL. 5, FIG. 13)

♂. 7·5–8·5 mm. long. Black. The following parts pale chrome-yellow: clypeus, face excepting a narrow black line dilated above of each side of the frontal carina, a very small spot on each side of the pronotal collar, outer third of the tegulae, a small apical spot on each side of the second tergite, apical bands on the third and fifth tergites, that of the third dilated laterad, the tibiae excepting a black streak on the underside and the base of the metatarsi. Fore and middle tarsi ochreous, the hind pair dark brown. Flagellum dark brown, the second to sixth and the apical joints pale ferruginous below. Wings hyaline, slightly fuscous at the apex, the veins and pterostigma black. Clypeus with decumbent yellowish pubescence, the rest of the body with a sparse, erect, and grey pubescence, long on the head, thorax, and first two tergites. Clypeus shining, shallowly punctured, the interspaces more than twice as wide as the punctures on the anterior half of the median area, the yellow areas of the face a little more closely punctured. Metapleura striato-rugose, the triangular area of the epinotum rugoso-punctate, grooved down the middle, the sulcus margined by a carina on each side; metanotum finely and sparsely punctured. The rest of the body coarsely reticulate-punctate, the punctures half as wide as the anterior ocellus, except on the upper part of the face, temples, and sternites, where they are a little smaller. On the scutellum the puncturation is not so close as elsewhere, the interspaces being as wide as the punctures.

Median area of the clypeus one-fifth longer than wide. Second joint of the flagellum one-third longer than wide, very little longer than the third joint. Posterior ocelli half as far again from the eyes as from each other.

Pronotal collar in the middle a little longer than the second joint of the flagellum, the shoulders rounded. First tergite one-fourth longer than wide, nearly as long as the second, the latter not quite one-third wider than long and two and a quarter times wider at the apex than at the base. Second sternite with an ill-defined basal platform. Pygidial area two-fifths longer than wide at the transverse apex, its sides convex. Posterior tibiae with five feeble serrations.

Haramaia, May 1948, 1 ♂ type; Lekempti, May 1946, 1 ♂. The specimen from Lekempti lacks the yellow spots on the pronotum.

In the colour of the legs and scapes, and in the shape of the second tergite, this species resembles *C. macalanga* Brauns, but in spite of the difference in the colour of the first two tergites it is more closely related to *C. nigrostoma* Brauns, having like that species the median groove of the epinotal triangle margined on each side by a carina. The genitalia resemble those of *nigrostoma* and *macalanga*.

Cerceris celaeno sp. n.

(FIG. 15, PL. 5, FIG. 14)

♂. 7 mm. long. Deceptively like *C. macalanga* Brauns, but smaller, and differing from it in colour and sculpture as follows: Scape pale yellow below, clypeus and face creamy white or very pale yellow, sparsely and strongly punctured, the interspaces for the greater part three times as wide as the punctures. Triangular area of the epinotum not distinctly grooved down the middle, only with a thin and indistinct line, with four or five punctures near the middle and the lateral margins without the transversely costate grooves which are present in *macalanga*. Fifth tergite with a narrow pale yellow apical band, interrupted in the middle; in *macalanga* this segment is entirely black. Sixth tergite also with an apical yellow band, but much narrower than in *macalanga*. Pygidial area parallel-sided (in *macalanga* wider at the base than at the apex). Median area of the clypeus more convex than in *macalanga*, and the lower half of the orbits are parallel, not divergent as in that species. The dorsal aspect of the epinotum is almost semicircular, or about three times wider at the base than long, whereas in *macalanga* it is semi-ovate, or three-fifths wider at the base than long (Fig. 16). The first tergite is broader, being only one-third longer than wide, and is much less contracted caudad. The outer paramera of the genitalia are relatively shorter, extending barely beyond the apex of the sagittae, and with the widened apical portion much shorter. Otherwise like *macalanga* Brauns.

Moggio, Ethiopia, June 1946, 1 ♂.

I gave a corrected description of *macalanga* ♂ in 1942 (*J. Ent. Soc. S. Afr.* **5:** 12).

Cerceris taygete sp. n.

(Figs. 17, 17*a*; Pl. 5, fig. 15)

♂. 7·5 mm. long. Black, the following parts pale yellow: base of the mandibles, clypeus excepting a wide black anterior margin, sides of the face, a small spot on each side of the pronotal collar, outer half of the tegulae, a small subrectangular spot on each side of the second tergite near its base, a transverse band, slightly dilated laterad, on the third tergite, a large triangular spot on each side of the third sternite, the apical half of the sixth tergite, the tibiae, tarsi, and the apex of the fore and middle femora. The tibiae with a black streak on the underside. Antennae brownish-black, the underside of the second to seventh joints reddish. Wings hyaline, the veins and pterostigma brown, the apex of the forewing faintly fuscous. Clypeus with large but not deep punctures, the interspaces larger than the punctures. Metapleura transversely striate, metanotum shining, with a few small punctures. Tumid areas of the sternites with a small and shallow puncturation. The rest of the body deeply reticulate-punctate; the largest punctures are on the thorax and tergites and are about half as wide as the anterior ocellus, those on the vertex and temples a little smaller. Triangular area of the epinotum with a median furrow, and with somewhat indistinct rugae divergent from the base outwardly. Median area of the clypeus fairly convex, one-fifth longer than wide, its apical margin straight and edentate. Dorsum of the pronotum as long in the middle as the second joint of the flagellum, horizontal, the shoulders obtusely angular. Prosternum with a denticle on each side near the middle. First tergite one-third longer than wide, the sides moderately convex, as wide at the base as at the apex.

Second tergite one-fourth longer than the first, three and a half times wider at the apex than at the base. Sixth sternite with a sharp tooth on each side. Pygidial area twice as long as wide, the lateral margins feebly convex, the apical margin straight. Posterior tibiae with six serrations. Outer paramera of the genitalia dilated at the apex, their ventral membraneous portion very large.

Gambeila, Ethiopia, February 1948, 1 ♂.

Related to *C. inconspicua* Arnold, from which it differs by the narrower face, the shape of the first tergite, the black femora, and the genitalia. In *inconspicua* the median area of the clypeus is only one-ninth longer than wide.

Subfamily Astatinae

Of this subfamily there are two examples of two species, of which one is too damaged to permit of determination. The other is the following:

Astata fuscistigma Cameron

1905, *Rec. Albany Mus.* **1**: 258, ♂.

Accra, Gold Coast, 1941, 2 ♀♀.

It is remarkable to find the range of this species extending to the tropical belt, since hitherto it has been recorded only from South Africa.

Subfamily Nyssoninae

Alysson guichardi sp. n.

(Fig. 18, 18*a*, and 18*b*; Pl. 5, fig. 19)

♀. 9 mm. long. Black. Pronotal dorsum, mesonotum, and scutellum fusco-ferruginous. The median area of the clypeus, excepting a black spot in the middle, a narrow line on each side of the face, the underside of the scapes, a large, subtriangular macula, the apex mesad, on each side of the second tergite, the underside of the anterior tibiae and the basal two-fifths of the hind femora, creamy white. Last three joints of the anterior tarsi reddish-yellow. A large macula at the middle of the mandibles, pale ochreous. Wings fusco-hyaline, the radial cell darker, the veins and pterostigma blackish.

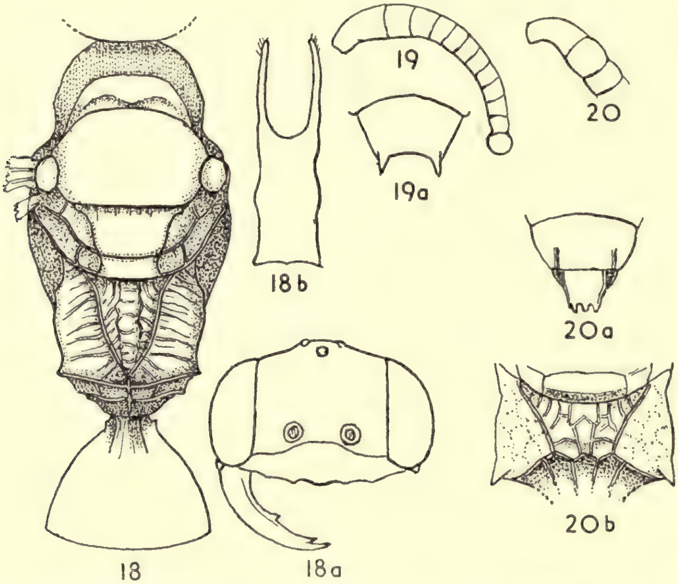


Fig. 18. *Alysson guichardi* ♀, thorax, × 15. Fig. 18*a*. *Alysson guichardi*, head, × 15. Fig. 18*b*. *Alysson guichardi* ♂, eighth sternite, × *c*. 34. Fig. 19. *Nysson quadricolor* ♂, flagellum, × 27. Fig. 19*a*. *Nysson quadricolor*, seventh tergite, × 27. Fig. 20. *Brachystegus senegalensis*, apical joints of the flagellum, × 15. Fig. 20*a*. *Brachystegus senegalensis*, apical tergites, × 12. Fig. 20*b*. *Brachystegus senegalensis* ♀, epinotum, × 12.

The lower half of the face with a sparse whitish pubescence, the clypeus, mandibles, declivity of the epinotum, the third and following tergites, and the underside of the femora with a white and very sparse pilosity. Clypeus smooth and shining. Face and temples almost dull, finely and very closely punctured, the interspaces about as large as the punctures. Vertex shining, sparsely punctured with small punctures intermixed with a few larger piligerous ones. Pro- and meso-thorax moderately shining, as finely punctured as the face, but more sparsely, the interspaces for the greater part three to four times wider than the punctures; from each of the latter there is emitted a small, erect, and black hair. Metapleura smooth and shining, the metanotum closely, finely, and shallowly punctured. Dorsum of the epinotum one-third wider than long, as wide at the base as at the apex, its lateral margins feebly convex; its median triangular area is defined by strongly raised margins and is as long as wide at the base. The middle third of the triangular area is margined by two zigzagged rugae with transverse rugae between them, and the outer thirds are obliquely costate. The sides of the dorsum outside the median area are transversely rugose, the rugae becoming wider apart and stronger caudad. Posteriorly the dorsum is margined by a strong carina which ends on each side in a broad and low tooth. The declivity has a median carina which nearly reaches the base and at its upper third is joined on each side by an oblique carina; the space between these carinae is coarsely reticulate-rugose. The sides of the epinotum are closely and obliquely rugose. Abdomen smooth, shining, and impunctate. Pygidial area broadly triangular, rounded at the apex, and clothed with adpressed golden setae.

Mandibles with two widely separated teeth on the inner upper margin. Clypeus short, three and a half times wider than long in the middle, with a deep transverse impression behind the apical margin. Inner orbits slightly divergent dorsad. Posterior ocelli half as far again from the eyes as from each other. Interocular distance on the vertex equal to the length of the first three joints of the flagellum plus two-thirds of the fourth joint. Flagellum slender, the first joint twice as long as wide, the second a little more than four times longer than wide at the apex and one-third longer than the third, all the remaining joints at least twice as long as wide. Pronotum, excluding the neck, four and a half times wider behind than long in the middle, convex transversely and lengthwise, and with a transverse depression in front of the hind margin. Mesonotum one and a half times longer than wide at its widest. First tergite a little wider behind than long, the basal third concave in the middle and divergently striate, the lateral angles dentate. Posterior tibiae with a row of short spines fringed with long white hairs on the upper margin. First abscissa of the radius three times as long as the second, the latter a little longer than the petiole of the second cubital cell.

♂. 6·5 mm. long. The whole of the clypeus and the posterior corners of the pronotum, below the tegulae, creamy white. Hind metatarsus also of that colour, except at the base and apex. Otherwise coloured like the ♀. The puncturation of the head and thorax, in view of the smaller size, is somewhat larger than in the ♀. The sculpture of the epinotal dorsum, outside the triangular area, is coarser than in the ♀, and consists of about seven oblique costae with the interspaces transversely rugose. Mandibles with a small tooth on the inner margin behind the apex. First joint of the flagellum subglobose, the second joint one and a half times longer than wide, barely as long as the third, the apical joint truncate at the apex, concave below and twice as long as wide at the base. Interocular distance on the vertex equal to the length of the first four joints of the flagellum plus half of the fifth. First tergite one-fifth longer than wide behind, more deeply concave in the middle of the base than in the ♀. Posterior tibiae only feebly spinose. Apical sternite deeply bifurcate, the apical tergite longitudinally rugulose, its apex widely rounded. Otherwise like the ♀.

Ghedo, Ethiopia, 7,500 ft., May 1946, 2 ♀♀, 1 ♂.

This species differs considerably from the other African species, *guillarmodi* Arnold, and is more closely related to the European *ratzeburgi* Dahlbom, from which it differs in the sculpture of the epinotum and the colour of the scutellum and the legs. It is noteworthy that both of the African species inhabit mountainous country.

Nysson quadricolor sp. n.

(FIGS. 19, 19*a*; PL. 5, FIG. 20)

♀. 5 mm. long. Head black, the base of the mandibles dull yellow, the underside of the scapes and of the first four joints of the flagellum yellowish-white, the rest of the flagellum dark brown. Pronotal collar, except in the middle, pale yellow, the tips of the epinotal teeth translucent and yellowish, the rest of the thorax dark ferruginous, the anterior third of the mesonotum fusco-ferruginous. Tergites 1–4 black, the first with a large pale ochreous macula on each side of the apical half, the second to fourth with apical bands of the same colour, narrowly interrupted in the middle, the sternites and the last two tergites ferruginous. Legs fusco-ferruginous, the upper side of all the tibiae yellowish-white, the tarsi reddish-brown. Wings hyaline, the veins black. The whole body dull and with a very short, decumbent, and whitish pubescence, scanty on the tergites. Clypeus finely and closely punctured, transversely impressed behind the straight apical margin. Face with a small and not very close puncturation, the interspaces closely striate lengthwise. The vertex and temples are more deeply and more closely punctured, almost reticulate-punctate; the temples separated from the foramen by a high carina. Inner orbits strongly convergent below, the interocular distance on the vertex being twice as great as across the base of the clypeus, the latter twice as wide as long. Between the antennal sockets there is a transverse torus. Scapes obconical, about half as long again as wide at the apex; flagellum moderately clavate, the first joint transversely ovoid, the second to eighth wider than long, the ninth and tenth as wide as long, the apical one and a half times wider than long. Posterior ocelli very little farther from the eyes than from each other. Pronotal dorsum feebly punctured, its anterior margin convex, the shoulders subdentate. Metapleura smooth, feebly and transversely striate at the base. Dorsum of the epinotum short, in the middle about half as long as the scutellum, with about six oblique carinulae, the lateral angles produced into stout conical teeth. The rest of the thorax coarsely reticulate-punctate. Mesonotum nearly one and a half times wider in front than long, the scutellum twice as wide as long, the sides of the metanotum slightly elevated. Tergites strongly and closely punctured, the punctures a little smaller than those of the mesonotum, the interspaces microscopically striate (40 diameters). Second sternite punctured like its tergite, the other sternites smooth, excepting their apical thirds which are sparsely punctured. Pygidium triangular, the apex rounded, about one and a half times longer than wide at the base. First abscissa of the radius five times longer than the second, a little shorter than the third, the petiole of the second cubital cell half as long again as the second abscissa; the cubitus of the hindwing is emitted from the end of the submedial cell.

♂. 5·6 mm. long. Clypeus and the underside of the scapes and of the first six joints of the flagellum pale yellow, the rest of the antennae reddish-brown. Fifth tergite with a pre-apical ochreous band as in the preceding tergites, the sixth and seventh ferruginous, the sternites blackish. Clypeus four times wider than long. Flagellum clavate, the second to tenth joints more than one and a half times wider than long, the eleventh wider than long, the apical curved, twice as long as wide at the base, compressed dorso-ventrally at the apex, which is transverse. Shoulders of the pronotum rounded. Apical angles of the seventh tergite spinose. First abscissa of the radius as long as the third. Outer paramera of the genitalia semi-cylindrical beyond the base, widened towards the apex; the sagittae with a semicircular dilatation on the outside at the end of the middle third. Otherwise like the ♀.

Tillembeya, French Sudan, August 1944, 1 ♀, 1 ♂.

Remotely related to *N. braunsii* Handlirsch, from which it differs in colour, sculpture, and in the absence of the angular frontal tubercle behind the inter-antennal torus.

Brachystegus senegalensis sp. n.

(FIGS. 20, 20*a*, and 20*b*; PL. 5, FIG. 21)

♀. 7·5–10 mm. long. Head and thorax black. Abdomen reddish-brown, the first five tergites with a median triangular black area extending from the base to the apex, and at the basal angles extended to the lateral margins. Clypeus, sides of the face, and the temples covered with a long, dense, adpressed yellowish silvery pubescence, concealing the sculpture; the middle of the face and the vertex with less dense, shorter, and a yellower pubescence, intermixed with setulae. The pronotum, sides of the epinotal dorsum outside the median area, and the basal half of the first tergite also with yellowish silvery pubescence, concealing the underlying sculpture on the epinotal dorsum. A dense adpressed silvery pubescence covers the meso- and meta-sternum, the underside of the coxae and trochanters, femora, and the sternites. On the second sternite a sparse and shallow puncturation shows through the pubescence. Tibiae and tarsi with decumbent silvery pubescence, the hind tibiae also with a row of short spines on the upper outer margin, and also with white setulae. Wings pale fuscous. Face and vertex with a shallow and not close puncturation, the punctures about one-fourth as wide as the anterior ocellus, the interspaces closely and miscroscopically punctured (25 diameters). Epicnemium glabrous and dull. Mesonotum, mesopleura and scutellum deeply pitted,[1] the pits about one-third as wide as the anterior ocellus and shining, the interspaces narrower than the pits and closely, microscopically punctured. Metapleura transversely rugose. Median area of the epinotal dorsum divided by carinae into thirteen unequal areolets which are shining. The declivity of the epinotum divided by carinae which converge ventrad into five areolets which are irregularly and transversely costate. Tergites dull, the first five with a fundamental close puncturation (16 diameters) on which is superimposed a larger sparse and shallow puncturation which becomes progressively finer on each succeeding segment.

Pygidial area closely punctured, nearly twice as long as wide at the base, the apex narrowly rounded. Anterior third of the clypeus inflected, glabrous and shining, the apical margin feebly convex. Interocular distance on the vertex three-fifths greater than across the base of the clypeus and equal to the length of the first seven joints of the flagellum. Face with a cariniform tubercle between the antennal sockets. Posterior ocelli two-fifths farther from the eyes than from each other. A short longitudinal carina margins the inner orbits of the posterior ocelli; they are more clearly visible when the head is viewed from in front. Second joint of the flagellum one-third longer than wide and as long as the third. Pronotal dorsum in the middle as long as the first joint of the flagellum, its anterior margin obtusely angular in the middle, the shoulders dentiform. Mesopleura with an uneven vertical carina in front of the posterior third, and ending dorsad in a broad, low tooth, just visible from above. Scutellum two-fifths wider than long, its posterior angles rounded. Posterior angles of the epinotal dorsum produced into teeth which are as long as wide at the base. First tergite three-fifths wider than long. As in all the species of the genus, the first sternite has a median longitudinal and shining ridge, ending abruptly before the apical margin and flanked by divergent carinae. First abscissa of the radius fully seven times longer than the second, the latter as long as the petiole of the second cubital cell. Cubitus of the hindwing emitted at a considerable distance beyond the end of the submedial cell.

---

[1] By pits are to be understood depressions having flat floors and vertical sides; punctures, on the other hand, have concave floors and sloping sides.

♂. 8·2–10·5 mm. long. Pubescence on the clypeus and face pale brassy golden. Flagellum fusco-ferruginous, the apical joint yellowish. Second to fifth sternites with apical fimbriae of curved golden hairs, directed cephalad. The black median maculae on the first, third, fourth, and fifth tergites do not reach the apical margin. The red lateral areas on the first and second tergites have traces of ochreous patches. Clypeus a little more than twice as wide as long in the middle, the glabrous inflected anterior third rugose and with two very small teeth on each side near the middle.

Inner orbits more strongly convergent below than in the ♀, the interocular distance on the vertex being nearly twice as great as across the base of the clypeus. Second joint of the flagellum a little longer than wide, the remaining joints excepting the last increasing gradually in width and all wider than long, the apical joint curved, compressed dorso-ventrally, and truncate at the apex. Sixth tergite with a longitudinal carina on each side near the lateral margins and extending only over the apical half of the segment. Pygidial area sharply carinate on the lateral margins, twice as wide at the base as at the apex, strigose lengthwise and closely punctured, the apex with three strong teeth. Otherwise like the ♀.

Diafarabé, French Sudan, August 1944, 2 ♀♀, 2 ♂♂.

Nearest to *B. decipiens* Arnold, from which it is distinguished, *inter alia*, by the colour of the wings, legs, and abdomen, the feeble tubercle on the face, and the absence of teeth on the inferior margin of the mesopleura.

Brachystegus senegalensis var. **aurantiacus** var. n.

♀. 9·5 mm. long. Black. Tibiae and tarsi reddish-brown, the extreme base and apex of the anterior tibiae pale ferruginous. Tergites 1 and 2 with triangular orange maculae on each side, occupying more than the apical half of the segments, tergites 3–5 with apical bands, interrupted in the middle and dilated laterad and of the same colour. Wings pale fuscous. Pubescence and sculpture like that of the species, excepting the tomentum on the second sternite which is much less dense and distributed in little separated patches.

♂. 7·5 mm. long. Colour as in the ♀. The decumbent pubescence on the sides of the epinotal dorsum is very sparse and absent on the basal half of the first tergite. Scutellum not so wide as in the type of the species, being only one-fifth wider than long, and with the lateral margins more convex.

Tillembeya, French Sudan, August 1, ♀, September 1944, 1 ♂.

There is so little difference between this variety and the smaller ♂ and ♀ of the species, except in the colour of the tergites, that it might be suspected that the colour in *senegalensis* has been affected by the vapour of cyanide. However, yellow colours are turned to bright red by cyanide and not to a reddish-brown. Moreover, in the ♂ of *aurantiacus* the sternites are without fimbriae.

Gorytes thalia montivagus subsp. n.

(PL. 5, FIG. 22)

G. thalia Handlirsch, 1895, *S.B. Akad. Wiss. Wien,* **104:** 1023 ♀; 1901, *Verh. Zool. bot. Ges. Wien,* **51:** 427, ♂, ♀.

♂. 7·5 mm. long. This differs from the type of the species as follows. Flagellum black. Yellow areas on the sides of the face narrower and abruptly contracted above. The spot on the posterior angles of the mesonotum yellow instead of red. Hind tibiae black on the inside. Hind tarsi with the basal joint and the basal half of the second joint pale yellow, the rest black. Apical margin of the fifth tergite rufescent, without a yellow band. Apical joint of the flagellum longer, three-fifths longer than wide at the base. Outer paramera of the genitalia narrower and blunter at the apex. The genitalia are peculiar, having a membranous velum connecting the outer and inner paramera, and, apparently, also the base of the sagittae. Between the inner and outer paramera the margin of the velum is produced into a short, curved and chitinized tooth.

♀. 7·5 mm. long. Middle and hind tibiae fusco-ferruginous, yellow on the outside. Hind tarsi fusco-ferruginous. Pygidial area scutate, narrowly truncate at the apex, nearly half as long again as wide at the base (as wide there as long in *thalia* i. sp.). Clypeus shorter, the apical margin straight and with a feeble median emargination.

River Hawash, 6,000 ft., Ethiopia, June, 1946, 1 ♂, 1 ♀.

The colour of the legs in the ♂ is like that of *G. emeryi* Grib., but the epinotum is not 'densely, coarsely punctured, and sub-reticulate'.

Ammatomus spiniferus Du Buysson var. **latus** var. n.

A. spiniferus Du Buysson, 1897, *Ann. Soc. Ent. France,* **66:** 359, ♀.

This variety differs from the type of the species only in having the puncturation of the mesonotum a little deeper and denser, and in the wider abdomen.

The first tergite is as wide behind as long, and the second three-fourths wider at the apex than at the base. In *spiniferus* i. sp. the first is one-fourth longer than wide behind, and the second is nearly twice as wide at the apex as at the base.

Didessa River, Ethiopia, 4,000 ft., May 1946, 2 ♀♀.

Subfamily STIZINAE

tridens group

Stizus braunsii Handlirsch

1894, *Ann. naturh. Hofmus. Wien,* **9:** 287.

Tillembeya, River Niger, August 1939–44, 3 ♂♂, 3 ♀♀; River Errer, near Harar, Ethiopia, May 1948, 2 ♂♂.

In *Ann. Transv. Mus.* **20** (2), 1940, Pl. V, figures were given of the genitalia of ten species of this very difficult group. Further examination shows that the degree of chitinization of the basal portion of the outer paramera and the width of the apical portion are somewhat variable.

Stizus haemorrhoidalis Handlirsch

1900, *Verh. Zool. bot. Ges. Wien.* **50:** 472.

Dilla, Ethiopia, April 1948, 2 ♂♂.

Stizus multiguttatus sp. n.

(FIGS. 21, 21*a*, and 21*b*)

♂. 8·5–9 mm. long. Related to *S. braunsii* Handlirsch, but larger and with more extensive and deeper yellow markings. Sculpture like that of *braunsii*.

Black. The following parts are chrome-yellow: mandibles excepting the apex, labrum, clypeus, face below the antennal sockets, and a narrow line on each side of the lower half of the face, scapes, underside of the first two joints of the flagellum, upper half of the pronotum including the tubercles, lateral margins of the mesonotum, tegulae, upper two-thirds of the mesopleura, a large more or less polygonal spot on each side of the scutellum, metanotum, posterior angles of the epinotum, a more or less semicircular macula on each side of the first tergite not reaching the apical margin, apical bands on the second to fifth tergites, bisinuate cephalad and abruptly, widely dilated laterad, an oblong macula on each side of the sixth tergite, lateral maculae on the second to fifth sternites, that on the second very large, underside of the coxae and trochanters, and all the legs excepting the basal third of the hind femora.

Upper side of the flagellum blackish, the underside, excepting the first two joints, pale ferruginous. Wings hyaline, the veins dark brown. Clypeus at its widest five-sevenths wider than long. Interocular distance on the vertex two and three-quarter times greater than across the base of the clypeus, the inner orbits therefore more convergent than in *braunsii*.

Third joint of the flagellum longer than in *braunsii*, being barely (one-eighth) shorter than the second, the latter nearly twice as long as wide. The three apical joints of the flagellum like those of *braunsii*, seventh tergite much less attenuated towards the apex than in *braunsii* (Fig. 21 *c*). The outer paramera of the genitalia much wider than in *braunsii*.

♀. 8–10 mm. long. Second cubital cell not petiolated, the first and second transverse cubital veins meeting on the radius. Sixth tergite entirely black, and all the femora have a black streak on the upper side at the base. Otherwise like the ♂ in colour, but the apical bands of yellow on the tergites are less deeply bisinuate on their anterior margin.

In one of the 3 ♀♀, the yellow bands are much reduced on the second and following tergites.

Second joint of the flagellum twice as long as wide, one-fourth longer than the third. Otherwise like the ♂.

Tillembeya, River Niger, French Sudan, August 1944, 5 ♂♂, 3 ♀♀.

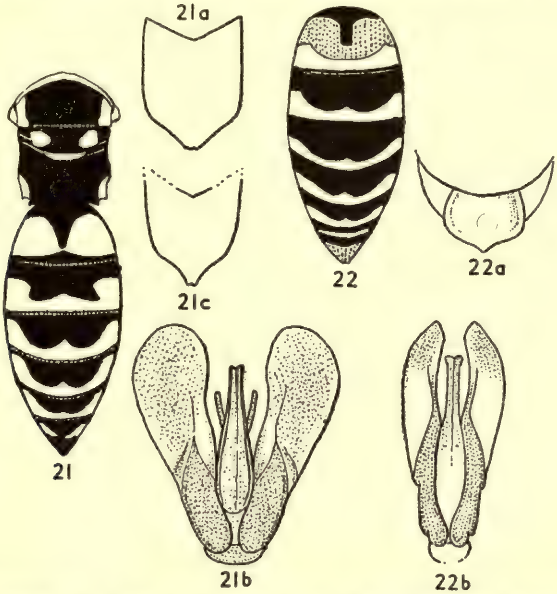


FIG. 21. *Stizus multiguttatus* ♂, ×6. FIG. 21*a*. *Stizus multiguttatus* ♂, seventh tergite, ×*c*. 10. FIG. 21*b*. *Stizus multiguttatus*, genitalia, ×*c*. 22. FIG. 21*c*. *Stizus braunsii* ♂, seventh tergite, ×*c*. 10. FIG. 22. *Stizus sudanensis* ♂, abdomen, ×4. FIG. 22*a*. *Stizus sudanensis*, seventh sternite, ×*c*. 12. FIG. 22*b*. *Stizus sudanensis*, genitalia, ×16.

Stizus corpulentus Arnold

1929, *Ann. Transv. Mus.* **13**: 270.
1939, *Occ. Pap. Rhod. Mus.* **5**: 27.

Lake Bishoftu, 7,000 ft., Ethiopia, May 1946, 1 ♀. A slight variety in which the clypeus is entirely black, and the pale bands on the abdomen are glaucous white instead of yellow.

discolor group

Stizus sudanensis sp. n.

(FIGS. 22, 22*a*, and 22*b*)

♂. 12 mm. long. Black. Lateral margins of the mesonotum, and of the epinotum, first tergite excepting a median black T-shaped area at the base, and seventh tergite, ferruginous. Sternites fusco-ferruginous. The following parts are yellow: mandibles excepting the apex, labrum, clypeus, face below the antennal sockets, a narrow line on the lower half of the sides of the face, scapes, upper half of the pronotum, a triangular macula on each side of the scutellum, apical bands on the first six tergites dilated laterad and also slightly and angularly in the middle, and apical bands on the second to sixth sternites more or less interrupted medially.

Legs yellow, middle and hind femora flavo-ferruginous. Flagellum dark brown above, flavo-ferruginous below.

Wings hyaline, slightly yellow, the veins dark brown. Clypeus and lower half of the face with decumbent silvery pubescence. The puncturation on the head and thorax, excepting the epinotum, is very shallow and microscopic. On the epinotum outside the median triangular area the punctures are larger, less oblique, and closer, the interspaces being as wide as the punctures. The abdomen has the fine oblique and shallow puncturation common to the species of the genus. Clypeus twice as wide in front as long. Interocular distance on the vertex very nearly twice as great as across the base of the clypeus. Second joint of the flagellum nearly three times longer than wide and one-sixth longer than the third, the three apical joints as in *nyasae* Turn. but the spine on the tenth joint is less angularly bent at the apex. Ocelli as far from the eyes as from each other. Dorsum of the epinotum short, not longer than the scutellum. Seventh sternite fairly strongly punctured in the basal half, concave, the lateral margins being somewhat swollen, without a median tubercle. Anterior femora strongly compressed. First abscissa of the radius three times longer than the second.

Tillembeya, River Niger, French Sudan, September 1944, 1 ♂.

Like *S. nyasae* Turner, the other member of this group, this species differs from *S. discolor* Handlirsch in the lack of a median tubercle on the seventh sternite.

Stizus nyasae Turner var. **robustus** var. n.

(FIG. 23)

S. nyasae, Turner, 1912, *Ann. Mag. Nat. Hist.* **10:** 338.

♂. 13 mm. long. This variety differs from the type of the species only in the greater size and extent of the yellow colour. The two small yellow lines on the disk of the mesonotum which are present sometimes in *nyasae* are here developed into two large longitudinal bars extending over the anterior two-thirds of the segment. The scutellum is black only over its anterior third, and the whole of the epinotum is yellow excepting a narrow black basal band on the triangular area, and narrow black borders outside and adjacent to the lateral margins of that area. In three of the four specimens the yellow areas of the tergites are not crenulate as in the type of the species;[1] their anterior margins are less indented on the second and third tergites and on the remaining tergites larger.

The genitalia are identical. The outer paramera have a narrow dorsal face, and a wider outer face.

♀. 12 mm. long. One specimen of this sex, from the same locality as the males, differs from the ♀ of typical *nyasae* in having all the black parts replaced with ferruginous.

Tillembeya, River Niger, French Sudan, September 1944, 4 ♂♂, 1 ♀.

[1] The heraldic term 'vair' accurately describes the arrangement of the colour in *nyasae* i. sp.

caffer group

Stizus laterimacula fraudulentus subsp. n.

(FIG. 24)

S. laterimacula Handlirsch 1895, *S.B. Akad. Wiss. Wien*, **104:** 980.

♂. 11–12 mm. long. Smaller than *laterimacula* i. sp., and with a very different colour pattern on the abdomen, but with the genitalia barely distinguishable.

Puncturation and pubescence as in the type of the species. Black. The following parts pale chrome yellow: mandibles, labrum, clypeus, face below the antennal sockets and at the sides and a broad median line reaching the anterior ocellus, scapes, a narrow line on the temples adjacent to the eyes, upper half of the pronotum including the tubercles, sides of the mesonotum, upper half of the mesopleura and a triangular macula below it, subtriangular and transverse maculae on each side of the scutellum, the metanotum, two oblong spots on the median area of the epinotum, the outer half of the sides of the epinotal dorsum and the lateral margins of the declivity, lateral semi-elliptical maculae on the first tergite, apical bands on the second to sixth tergites crenulated and similar to those of *S. nyasae* and *S. loriculatus*, an indistinctly margined median macula on the seventh tergite, small transverse maculae on the second to sixth sternites and the legs. The femora pale rufous on the upper side. Flagellum ferruginous. The apical margins of the sternites are pale brown. Wings hyaline, tinged with yellow, the veins yellowish-red.

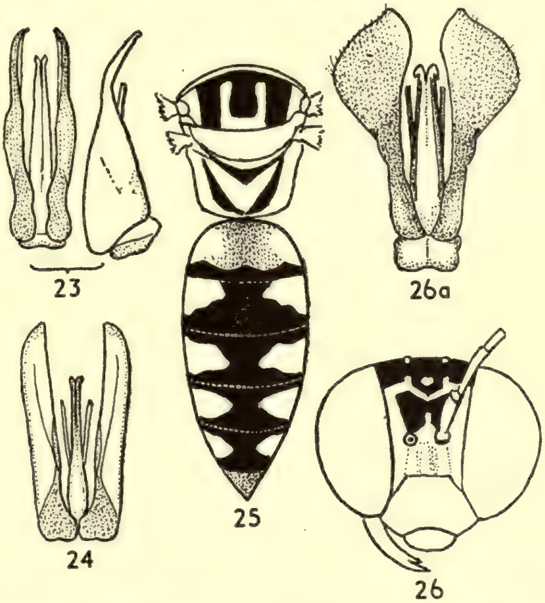


FIG. 23. *Stizus nyasae robustus* ♂, genitalia, ×12. FIG. 24. *Stizus laterimacula fraudulentus* ♂, genitalia, ×12. FIG. 25. *Stizus nigriventris* ♂, ×3. FIG. 26. *Stizus bensoni* ♂, head, ×6. FIG. 26*a*. *Stizus bensoni*, genitalia, ×12.

The inner orbits are a little more convergent below than in *laterimacula* and the var. *euteles*, the interocular distance on the vertex being three-fifths greater than across the clypeus, and the anterior margin of the latter is concave and not straight as in the others. As in all the species of this group the hind tibiae are transversely compressed and curved outwardly. The genitalia are almost identical with those of *laterimacula* i. sp., the only difference being the slightly more rounded apex of the outer paramera and the heavier chitinization of the inner margin.

Kaffrine and Kaolack, Senegal, August 1943, 2 ♂♂.

On account of the colour pattern of the abdomen, this insect could easily be mistaken for *nyasae* or a small *loriculatus*. It may be noted here that *euteles* Handlirsch, which I reduced to a variety of *laterimacula* (1929, *Ann. Transv. Mus.* **13:** 282) differs from the latter and this race in having the outer paramera of the genitalia densely pilose on the underside.

fasciatus group

The majority of the species in this group are very similar in the female sex, and a revision based on the male genitalia is greatly needed, and would probably reduce some of the supposed species to subspecific, or even varietal, rank. Unfortunately the ♂♂ of some of them are at present unknown. It is therefore with some hesitation that I describe as a new species two ♀♀, without the corresponding ♂.

Stizus nigriventris sp. n.

(FIG. 25)

♀. 20–23 mm. long. Mandibles excepting the black apex, labrum, clypeus, face at the sides and below the antennal sockets and the whole of the outer half of the occiput pale ochreous yellow, the inner half of the occiput black. The yellow at the sides of the face with an extension inwards almost enclosing the anterior ocellus. The dorsum of the thorax is mainly reddish ochreous, but the upper two thirds of the pronotum is pale yellow; the black areas are: the mesonotum excepting the lateral margins and a large rectangular U-shaped median area extending from the anterior to the posterior margin, a short triangular band on the base of the median area of the epinotum and the inner half of each side of the epinotal declivity. Meso- and metapleura black, excepting a large macula covering the upper two-thirds of the former, and an oblong macula on the upper half of the metapleura. The underside of the thorax, including the coxae and trochanters, is entirely black. First tergite pale ferruginous, with a large and distinctly defined yellow macula on each side and a black apical band angularly dilated laterad. Second to fifth tergites black with large subtriangular maculae on each side, their apices mesad. Sixth tergite ferruginous, covered with a dense reddish-golden pubescence. Sternites entirely black. Legs and antennae flavo-ferruginous. Wings flavo-hyaline, the veins flavo-ferruginous, the radial, second and third cubital cells, and apical half of the second discoidal cell, fuscous. Clypeus and face with a silvery pubescence, the thorax with a very short greyish and inconspicuous pubescence. Head and thorax dull, microscopically reticulate-punctate, the labrum and anterior half of the clypeus less dull and a little more strongly punctured. Tergites 1 to 5 moderately nitid, very shallowly, finely and closely punctured. Sternites dull, microscopically reticulate and with a very sparse and shallow puncturation superimposed. Clypeus a little more than twice as wide as long, the anterior margin moderately concave.

Inner orbits subparallel over the lower two-thirds. Interocular distance on the vertex equal to the length of the first two joints of the flagellum plus four-fifths of the third and only one-fifth greater than the interocular distance across the base of the clypeus. Second joint of the flagellum not quite five times longer than wide at the apex, and fully twice as long as the third. Apical joint slightly curved, a little longer than wide at the base. Posterior ocelli two-thirds farther from each other than from the eyes. Pygidial area not marginate, triangular, narrowly rounded at the apex. First abscissa of the radius slightly longer than the second. Basal joint of anterior tarsi with six spines.

Tillembeya, River Niger, French Soudan, September 1944, 2 ♀♀.

This differs from *auriflus* and *multicolor*, *rubroflavus*, and *rubellus* Turner in the colour of the dorsum of the thorax, especially the V-shaped macula of the mesonotum, and the entirely black sternites. The clypeus is not deflected in the anterior half as it is in *rubroflavus*.

Stizus basalis Guérin

1844, *Icon. Règne anim.*: 438.

Tillembeya, River Niger, French Sudan, Sept. 1944, 1 ♂, 3 ♀♀.

Stizus bensoni sp. n.

(FIGS. 26, 26*a*)

♂. 17 mm. long. Black. The following parts are bright chrome-yellow: basal half of the mandibles, labrum, clypeus, lower half of the face, a line on the sides of the face joining a transverse M-shaped bar above, a line on the temples margining the posterior orbits, two small spots on the posterior margin of the vertex, the upper margin of the pronotum including the tubercles, the lateral margins of the mesonotum narrowly, a subtriangular macula on each side of the scutellum, the metanotum, narrow lines margining the median area of the epinotum but not meeting at the apex, an oblong spot on the upper angles of the epinotal declivity, transverse bands, widely interrupted mesad and widest laterad on the first six tergites. Seventh tergite fusco-ferruginous and with pubescence of the same colour. Sternites 1–6 black, the apical margins brownish-yellow, narrowly on the first three, more widely on the fourth to sixth, the seventh sternite fusco-ferruginous. Legs and flagellum ferruginous, the coxae and trochanters black. Wings hyaline tinged with yellow, the veins reddish-yellow. Head and thorax with exserted yellowish-grey pubescence, fairly long on the epinotum. Head and thorax dull, the sides of the epinotum nitidulous. Clypeus and face and vertex microscopically and very closely punctured, pronotum almost smooth, the rest of the dorsum of the thorax very finely, obliquely and closely punctured, the interspaces barely larger than the punctures except on the anterior third of the mesonotum where the puncturation is sparser. Mesopleura as closely punctured as the mesonotum, but the punctures are round and a little larger. Metapleura and sides of epinotum almost smooth. Tergites nitidulous, less closely and more obliquely punctured than the mesonotum, the sternites less closely than the tergites.

Clypeus distinctly convex lengthwise, nearly six-sevenths wider than long, the anterior margin concave. Face below the antennal sockets slightly raised in the middle, but not subcarinate. Inner orbits feebly convergent below; the interocular distance on the vertex equal to the length of the first three joints of the flagellum plus half of the fourth and one-fourth greater than the least distance between the eyes below. Posterior ocelli not quite twice as far from each other as from the eyes. Second joint of the flagellum slender, curved, five times longer than wide at the apex and two-thirds longer than the third joint. Apical joints twice as long as wide at the base, concave below, curved, rounded at the apex. Declivity of the epinotum feebly concave. Seventh tergite widely rounded at the apex. First cubital vein straight, first abscissa of the radius a little shorter than the second. Outer paramera of the genitalia flat and lamelliform in the apical half, the outer margin almost semicircular.

Koundé-Saré, River Niger, French Sudan, August 1945, 1 ♂.

Although the first transverse cubital vein is straight as in the *ruficornis* group, this species is evidently closely related to *imperialis* Handlirsch, as is seen by the shape of the genitalia. In *imperialis* the outer paramera are not so widely dilated as in this species and with the outer margin of that part bluntly angular instead of semicircular (1936, *Occ. Pap. Rhod. Mus.* **5**: 15, fig. 6). Named after Mr. R. B. Benson, Department of Entomology, British Museum (Natural History).

Stizus ferrugineus Smith

1856, *Cat. Hymen. B.M.* **4**: 342.

Meisso, Ethiopia, August 1945. 1 ♂.

Stizus ritzemae Handlirsch

1895, *S.B. Akad. Wiss. Wien,* **104**: 1000, ♀.

Accra, Gold Coast, September 1941, 1 ♀.

This specimen agrees fairly well with Handlirsch's description, but the first tergite is entirely ferruginous.

In the absence of the ♂ a comparison of the genitalia is not possible, but I strongly suspect that *ritzemae* is only a colour variety of *ferrugineus* Sm.

tridentatus group

Stizus amoenus Smith

1856, *Cat. Hymen. B.M.* **4**: 338.

Tillembeya, River Niger, French Sudan, September 1944, 1 ♂.

Stizus mionii Guérin

1844, *Icon. Règne anim.* 438.

Koundé-Saré, River Niger, French Sudan, August 1945, 1 ♀, 5 ♂♂.

Subfamily BEMBICINAE

In the descriptions of new species which follow I have not given a lengthy and detailed account of the colour pattern since I am of the opinion that that can be more easily appreciated by illustrations in the text-figures. There are, of course, minor individual variations, but on the whole there is a basic pattern peculiar to each species.

In the descriptions of new species of this genus I have had occasion to refer to other African species, comparing the genitalia and the colour-pattern of the tergites. The reader should therefore refer to my monograph of the African Sphecidae (1929, *Ann. Transv. Mus.* **13** (4)) in which figures of the genitalia have been given of the majority of the species, and to the plate illustrating the pattern of the tergites. In this genus the outer paramera of the genitalia have a ventral membranous ramus which in the natural state cannot be seen from the dorsal aspect (see Figs. *27b* and *28b*) but which is made visible if pressure is applied to the base of the dorsal rami so as to splay them out.

The collection contains females of three or four possibly new species which, in the absence of any striking specific character, it would be unwise to name and describe in the absence of the other sex.

Bembix splendida sp. n.

(FIGS. *27*, *27a* and *27b*)

♂. 20 mm. long. Mandibles, labrum, clypeus excepting a bi-arcuate black macula covering the basal two-thirds, sides of the face up to the level of the anterior ocellus, pale yellow. The rest of the face and the vertex, excepting a quadrate black macula covering the ocellar area, flavo-ferruginous. Occiput black, the outer part, widening ventrad, flavo-ferruginous above, merging into pale yellow below. Clypeus with silvery pubescence, the rest of the head with a long, fairly dense, erect and greyish pubescence. Pronotum ferruginous, the rest of the thorax black, with the following parts deep lemon-yellow; a narrow transverse band on the posterior half of the scutellum, the basal half of the metanotum, a wide V-shaped area margining the median epinotal area and large triangular maculae, the apex mesad, on the posterior angles of the epinotal dorsum. Lateral margins of the mesonotum and the tegulae pale ferruginous. Mesonotum and scutellum with erect yellowish-grey pubescence, the rest of the thorax, including the pleura and sterna, with a long, erect, abundant and whitish pilosity. Tergites 1–6 yellow, the extreme base and apex of each one black, the yellow areas enclosing a black spot on each side of the middle, on the first and second, the spots on the third to fifth quadrangular and contiguous with the basal black margin. The base and apex of the sixth and the whole of the seventh, pale ferruginous. Sternites black, the second to fourth with a small lateral yellow maculae. Abdomen with a decumbent, short and yellowish pubescence. Antennae and legs, not including the coxae and trochanters, ferruginous, the apical joints of all the tarsi, excepting the extreme base, black. Wings clear hyaline, the veins brown.

Labrum and clypeus slightly shining, sparsely and finely punctured. Dorsum of the thorax dull, densely and very finely punctured, the punctures round. Pleura and sterna dull, closely punctured, the punctures oblique and a little larger than those of the mesonotum. Tergites nitidulous, finely, obliquely punctured, the interspaces about three times wider than the punctures. Sternites shining, the second with a smooth, very sparsely punctured median triangular area ending in a short carina, truncate or dentiform at its apex, the sides are closely and obliquely punctured, the following sternites less strongly punctured, the sixth with a raised semi-elliptical platform, acute at the apex, the seventh with a shining median carina. The seventh tergite is sparsely and coarsely punctured, abruptly attenuated near the apex.

Clypeus twice as wide as long, subcarinate at the base, the apical margin concave. Inner orbits moderately divergent below the middle. Interocular distance on the vertex equal to the length of the first two joints of the flagellum plus four-fifths of the third. Second joint of the flagellum four times longer than wide, and three-fifths longer than the third, the sixth and following joints excavated below, the seventh bidentate on the outer margin, the apical acuminate, two and a half times longer than wide at the base. Anterior coxae for the greater part pale yellow. Middle metatarsi dilated below near the base. Middle femora not dentate on the hind margin.

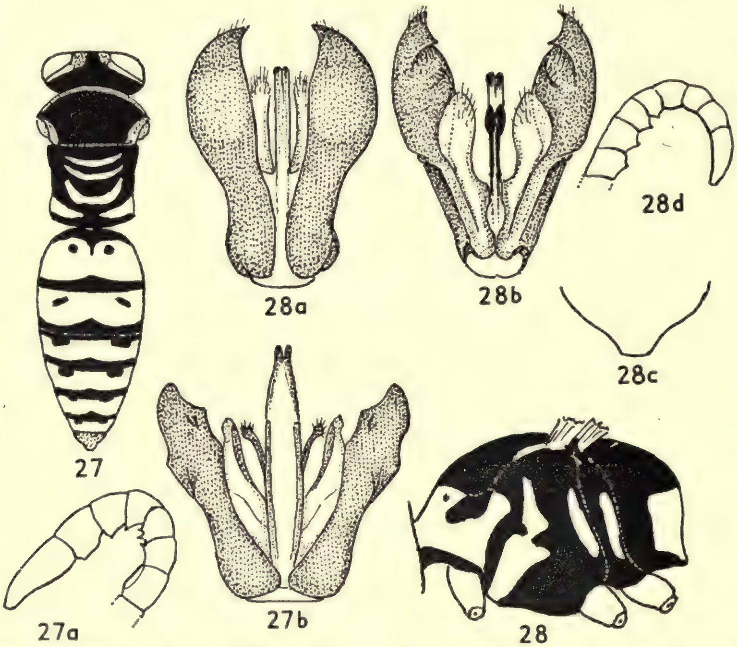


FIG. 27. *Bembix splendida* ♂, ×*c.* 2·7. FIG. 27*a*. *Bembix splendida*, apical joints of flagellum, ×13·5. FIG. 27*b*. *Bembix splendida*, genitalia, ×14·5. FIG. 28. *Bembix fantiorum* ♂, thorax, ×7·5. FIG. 28*a* and *b*. *Bembix fantiorum*, genitalia, dorsal and ventral view, ×13·5. FIG. 28*c*. *Bembix fantiorum* ♂, apical tergite, ×12. FIG. 28*d*. *Bembix fantiorum* ♂, apical joints of the flagellum, ×13·5.

Koundé-Saré, River Niger, French Sudan, August 1945, 3 ♂♂.

Related to *ugandensis* Turner, from which it differs by its smaller size, ferruginous legs and antennae, the round puncturation of the thorax, the colour of the last four tergites, the unarmed middle femora, and the genitalia.

This species belongs to the *diversipennis* group.

melanopa group

Bembix fantiorum sp. n.

(FIGS. 28, 28*a–d*)

♂. 14–15 mm. long. Black. The following parts are pale yellow: the sides of the labrum and clypeus to a varying degree, sometimes the former has only the median third black, and the clypeus may be entirely black, the sides of the face, two small spots below the ocellar area, the outer orbits, mandibles excepting the apex, pronotum, lateral margins of the mesonotum and sometimes two longitudinal streaks on the anterior half of the same, sometimes the hind margin of the scutellum, the greater part of the mesopleura, the metapleura excepting the margins, and the anterior and posterior thirds of the sides of the epinotum.

First five tergites in the middle with transverse bands of glaucous white, becoming yellower laterad, bisinuate cephalad, and more or less interrupted in the middle; the sixth tergite with two whitish spots. The shape of these bands is like that of *melanopa*, and as in that species the yellow band on the second tergite sometimes encloses a black spot on each side (see *Ann. Transv. Mus.* **13,** 1929, Pl. 4, figs. 16 and 17).

Sternites 2–5 with triangular yellow maculae at the sides. Antennae black, the last three joints ochreous below. Legs yellow, coxae and trochanters partly black, the underside of the fore and middle tarsi black, the anterior femora on the upper side and the anterior tibiae both above and below with black streaks, the middle and hind femora with small black streaks above near the apex and at the base below, the middle and hind tibiae with black streaks above and below. Wings clear hyaline.

Labrum and clypeus with a few scattered punctures.

Thorax dull, closely and obliquely punctured, tergites nearly dull, a little more finely punctured than the thorax. Sternites shining, coarsely and obliquely punctured, the second more densely so than the rest.

Clypeus very convex, two-thirds wider than long. Inner orbits slightly divergent below. Second joint of the flagellum three times longer than wide and half as long again as the third, the fifth to ninth spinose, the last three concave below. Middle femora with about eight teeth on the apical half of the hind margin. Tarsal comb with yellow spines, of which there are six on the basal joints. Second and sixth sternites as in *melanopa*, the seventh more narrowed in the apical part than in that species. The seventh tergite, coarsely punctured, is more narrowed apically than in that species and the apex is widely rounded.

♀. 15 mm. long. Mesonotum with a large U-shaped yellow macula, rectangular at the base. Hind margin of the scutellum and metanotum, and the posterior half of the median area of the epinotal dorsum, yellow. First tergite sometimes with two triangular yellow maculae on the declivious anterior face. The yellow bands on the second and third tergites usually enclose transverse black maculae, and the band on the first is usually entire. The sixth tergite is entirely black and more coarsely and more closely punctured than in the ♂, its lateral margins not sinuate, the apex narrower than in the other sex. The second sternite is closely punctured at the sides, much more coarsely and very sparsely in the middle. The black streak on the upper side of the hind femora is longer and wider than in the ♂.

Otherwise like the ♂ in colour, sculpture, and pilosity.

Second joint of the flagellum three and a half times longer than wide, and about one-third longer than the third joint. Apical joint moderately curved, compressed dorso-ventrally at the apex, and nearly three times longer than wide at the base. Tarsal comb fusco-ferruginous.

Labadi, Gold Coast, March–May, 22 ♂♂, 8 ♀♀; Kaolack, Senegal, August, 1 ♂, 2 ♀♀; Tillembeya, River Niger, September, 2 ♂♂, 2 ♀♀.

This is not *melanopa*, race *forcipata* Handlirsch (which is also richly yellow on the pleura), since, according to Handlirsch, the genitalia do not differ from those of the type of the species, but it is more closely related to *melanopa* i. sp. than to any other, in spite of the difference in the genitalia.

The species is named after the major native tribe of the Gold Coast.

Bembix guigliae sp. n.

(FIGS. 29, 29*a–c*)

♂. 14–16 mm. long. Black. Mandibles excepting the apex, labrum, clypeus at the sides and on the anterior margin, outer orbits more widely below than above, sides of the face, the bottom of the face above the antennal sockets, and a transverse bar with irregular margins below the ocellar area, yellow.

Underside of the scapes yellow, the upper side and the flagellum excepting the last three black joints ferruginous.

The yellow markings on the thorax are very much the same as those of the ♀ of the preceding species, *fantiorum* q.v., excepting that the U-shaped macula on the mesonotum is absent, and the maculae on the pleura are less extensive. The yellow is also of a deeper colour, deep chrome-yellow. The pattern of the deep chrome-yellow markings on the first five tergites is also very similar to those of *fantiorum*, but the enclosed transverse black maculae are often continuous with the basal black area on the second tergite and always so on the third. Sixth tergite black at the base, the apical third ferruginous, seventh tergite fusco-ferruginous, with the basal third black. Sternites 1–6 fusco-ferruginous in the middle, blackish laterad, the second to fifth with triangular yellow maculae at the sides; sixth sternite black over the basal half, and ferruginous on the apical. Legs yellow, the anterior tibiae with an oblong black macula on the underside, the fore and middle femora with a black streak above, and a short one on the underside at the base; the hind femora have only a black and short macula at the base. Wings hyaline, tinged with yellow, the forewing slightly darker over the basal half but not distinctly infuscated. Clypeus with adpressed silvery pubescence, the rest of the head, the thorax, and base of the first tergite with a long erect and yellowish-white pilosity.

The sculpture of the head, thorax, and tergites is like that of *B. fuscipennis* Le Peletier but a little finer. The puncturation of the sternites is deeper and more dense, especially on the second which has a ferruginous, compressed, and curved tooth like that of *fuscipennis*. The raised scutate platform on the sixth is narrower at the base than in *fuscipennis*.

The seventh sternite differs considerably from that of *fuscipennis*; the basal half is slightly flattened in the middle and the apical half is depressed, marginate over the basal half of its sides, and subcarinate in the middle. Basal joint of middle tarsi dilated basad as in *fuscipennis*. The antennae as in that species, but the tenth and eleventh joints of the flagellum are distinctly shorter. Middle femora without teeth on the hind margin.

♀. 14 mm. long. Sixth abdominal segment ferruginous, the yellow margin on the sides of the face and the transverse band below the ocellar area often broken up into three or four spots, flavo-ferruginous, the black maculae on the underside of the femora larger than in the ♂, otherwise like the ♂ in colour, sculpture, and pilosity.

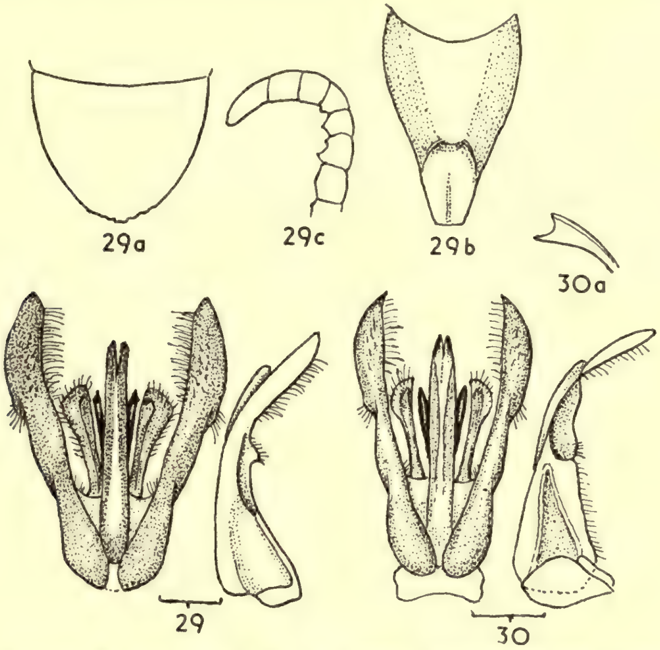


Fig. 29. *Bembix guigliae* ♂, genitalia, × 15. Fig. 29*a*. *Bembix guigliae* ♂, apical tergite, × 15. Fig. 29*b*. *Bembix guigliae* ♂, 7th sternite, × 15. Fig. 29*c*. *Bembix guigliae* ♂, apical joints of flagellum, × 15. Fig. 30. *Bembix fuscipennis* ♂, genitalia, × 20. Fig. 30*a*. Lateral view of apex of inner paramera.

Second joint of the flagellum four times longer than wide and twice as long as the third. Inner orbits feebly divergent below. Clypeus twice as wide as long.

Labadi and Accra, Gold Coast, March–May, 9 ♂♂; Kaffrine, Senegal, August, 1 ♂; Labadi and Accra, April and August, 6 ♀♀; Kaffrine, Senegal, 1 ♀; Tillembeya, River Niger, August, 1 ♂.

Named after Dottoressa Delfa Guiglia of the Genoa Museum who has published valuable papers on the African Sphecidae.

Closely related to *B. fuscipennis*, but with a different colour-pattern and sufficiently different genitalia. The outer paramera are wider than in *fuscipennis* i. sp. and much more densely pilose on the underside. In this species and in *fuscipennis* the inner paramera in the normal position and viewed from above have the appearance of cylindrical rods. They are actually rod-shaped basad, but are expanded and spatulate apically, with the anterior margin strongly concave.

On account of the yellow fasciae and maculae on the thorax this is not the *B. stevensoni* Parker. I take this opportunity to reply to some criticisms by Professor Parker (1942, *Proc. Ent. Wash.* **44:** 208). In my monograph of the African Sphecidae (1931, *Ann. Transv. Mus.*, **14:** 214) I stated that *stevensoni* was only a clear-winged variety of *fuscipennis*. I have a fairly large series before me, taken in many cases in the same localities and at the same times as the typical form. Professor Parker, in the paper referred to, contrasts in Pl. 18 the shape of the outer paramera with those of a specimen of *fuscipennis* i. sp. which he received from a Mr. Stevenson and stated to be determined by myself. He also says that this illustration, Fig. 15, is 'in all essentials identical with that given for this species by Handlirsch'. In view of the fact that labels are often misplaced, I accept no responsibility for determinations which do not carry my printed determination label and which are not obtained direct from me. Furthermore, the illustrations in Handlirsch's monograph are by no means reliable, being limited in most cases to the upper ramus of the stipes and so devoid of detail as to be semi-diagrammatic. His figure for *fuscipennis* is inaccurate, and I therefore give in Fig. 30 an illustration of the genitalia of that species. It will be seen that, on comparing this with Parker's figure of the genitalia of *stevensoni* (1929, *Proc. U.S. Nat. Mus.* **75,** Pl. 14, fig. 197), the only difference, a very slight one, is that the apical part of the stipes on this inner margin is very obtusely angular, whereas in *fuscipennis* i. sp. it is almost straight. Parker's Fig. 199 of the seventh tergite agrees with that of *fuscipennis*.

Bembix agrestis Parker

1929, *Proc. U.S. Nat. Mus.* **75:** 135.

Dessie, November 1945, 1 ♂; Lake Bishoftu, Ethiopia, 7,000 ft., February 1948, 2 ♀♀.

Bembix massaica Cameron

1910, *Sjöstedt's Kilimandjaro-Meru Exped.* **8:** 290.

River Hawash, S. of Adama, Ethiopia, June 1946, 12 ♀♀.

Bembix intermedia Dahlbom

1845, *Hymen. Eur.* **1:** 491.

Danakil, Mille River, 1,500 ft., Ethiopia, July 1946, 1 ♀.

Smaller than South African specimens, 12 mm. long.

Bembix cultrifera ypsilon subsp. n.

B. cultrifera Arnold 1929, *Ann. Transv. Mus.* **13:** 339.

♀. 16 mm. long. Disk of mesonotum with U-shaped yellow macula, the base touching the hind margin but the arms not reaching the anterior margin. The labrum is even shorter than in the type of the species, being but little longer than wide at the base. The flagellum is thinner, the second joint fully four times longer than wide, instead of three and a half. Wings short, the forewing not extending back beyond the apex of the fourth tergite.

Ufdem, Ethiopia, August 1945, 1 ♀.

Subfamily AMPULICINAE

Dolichurus ignitus contractus subsp. n.

D. ignitus Smith 1869, *Trans. Ent. Soc. Lond.*: 304.

♀. 8·5–10 mm. long. This race differs from *ignitus* i. sp. as follows. Apex of the clypeus, mandibles, tibiae, and tarsi blackish-brown. Last three abdominal segments and apical margin of the third fusco-ferruginous.

Face with faint traces of rugae at the sides, otherwise smooth, and, like the vertex, with a few very shallow punctures. The dorsum of the pronotum is more narrowed cephalad and less depressed in the middle, so that the posterior tubercles are less prominent, the transverse rugae on the anterior margin are reduced to faint striae, and the shoulders are distinctly dentiform and not merely rectangular. The dorsum of the epinotum is much more narrowed caudad, the base being three-fifths wider than the apical margin, whereas in *ignitus* i. sp. it is only one-seventh wider. The rugosity on the epinotal dorsum is much reduced, the transverse rugae being fewer. In the larger specimen (type) the hind margin is raised at the corners into blunt triangular teeth, but on the smaller specimen the margin is only slightly higher there.

Dilla (Sidamo), Ethiopia, April, 2 ♀♀.

Ampulex toroensis Turner

1919, *Ann. Mag. Nat. Hist.* **4:** (9) 45.

Adis Ababa, 1 ♂.

Ampulex sp.

Accra, Gold Coast, December 1941, 1 ♂.

Possibly the ♂ of one of the several species of Kohl described only from ♀♀.

Subfamily SPHECINAE

Sceliphron (Pelopeus) fulvo-hirtum Arnold

1928, *Ann. Transv. Mus.* **12:** 246.

Lekempti, Ethiopia, May 1946, 4 ♂♂.

Sceliphron (Hemichalybion) brachystylus Kohl

1888, *Verh. Zool. bot. Ges. Wien,* **38:** 154 ♀.
1918, *Ann. naturh. Hofmus. Wien,* **32:** 83 ♂.

Lake Bishoftu, Ethiopia, May 1946, 1 ♂.

Sceliphron (Chalybion) planatum sp. n.

(FIG. 31)

♂. 14 mm. long. Metallic blue, the abdomen steel blue, femora and tibiae purplish-blue, tarsi dark brown. Antennae black. Mandibles fusco-ferruginous. Wings hyaline, the apex beyond the cells narrowly fuscous. Clypeus and face with long silvery pubescence. The rest of the head and the thorax with outstanding, long, and whitish pilosity. The abdomen with adpressed greyish pubescence.

Clypeus distinctly convex, subcarinate medially on the anterior half, the apical margin tridentate. Face shining, fairly strongly, but sparsely punctured, the vertex shining with a few punctures, the temples impunctate. Thorax shining, the promesonotum very sparsely punctured, a little more finely than the face, the pronotum bituberculate. Mesopleura and mesonotum with very shallow, widely spaced punctures which, seen at a certain angle, form vertical lines. Metapleura not sunken, the surface on the same plane as the mesopleura and sides of the epinotum, with which they are so completely fused that the margins are almost obliterated; they are finely, shallowly, and sparsely punctured. Seen from the side, the outline of the mesopleura is almost a straight line, as in *S. heinii* Kohl.

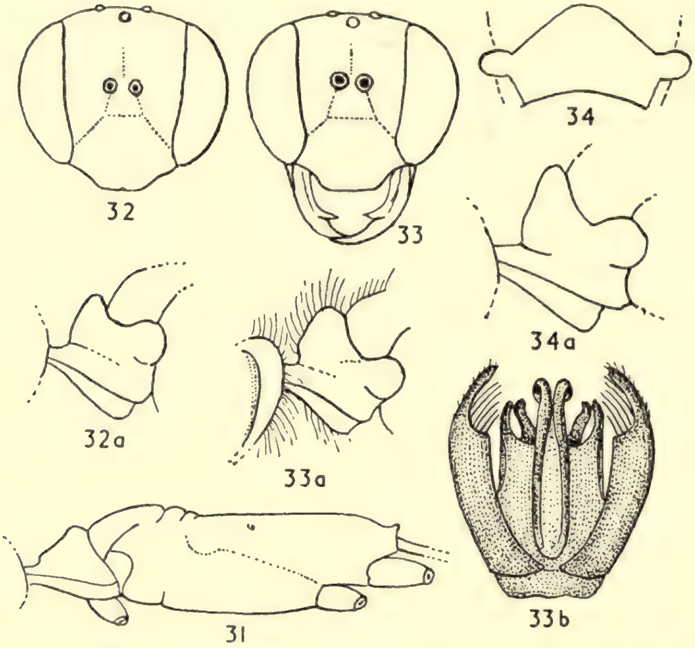


FIG. 31. *Sceliphron planatum* ♂, ×7½. FIG. 32. *Ammophila barbarorum* ♀, head, ×7½. FIG. 32*a*. *Ammophila barbarorum* ♀, pronotum, ×7½. FIG. 33. *Ammophila caprella* ♂, head, ×7½. FIG. 33*a*. *Ammophila caprella* ♂, pronotum, ×7½. FIG. 33*b*. *Ammophila caprella* ♂, genitalia, ×18. FIGS. 34 and 34*a*. *Ammophila argyrocephala* ♀, pronotum, front and side views, ×12.

Epinotum very long, transversely striate, the dorsum three times longer than the only slightly lower declivity. The dorsum is almost flat, not grooved down the middle. Petiole moderately curved, as long as six-sevenths of the hind metatarsus. Interocular distance on the vertex equal to the length of the second joint of the flagellum plus three-fourths of the third, and hardly greater than across the clypeus. Second joint of the flagellum barely longer than the third, and not quite three and a half times longer than wide at the apex. Third abscissa of the radius one-fifth longer than the second.

Danakil, Mille River, 1,500 ft., Ethiopia, July 1946, 2 ♂♂.

This species belongs to the section of *Chalybion* in which the metapleura are not sunken, and is not to be confused with *S. heinii* Kohl in which they are distinctly so.

Ammophila (Podalonia) tydei Le Guillou v. **capensis** Le Peletier

1845, *Hist. Nat. Ins. Hymén,* **3:** 368.

Lake Bishoftu, Lekempti, Haramaia, and Diredawa, Ethiopia, 4 ♂♂, 5 ♀♀, May–September.

Ammophila gracillima Taschenburg

1869, *Z. ges. Naturgesch.* **34:** 433.

Sardo, Ethiopia, July 1946, 1 ♂.

Ammophila beniniensis Palisot de Beauvois

1837, *Ins. rec. en Afr. et Amér.*: 48.

Moggio, Ethiopia, April 1948, 1 ♂.

Ammophila bonae-spei Le Peletier v. **ferrugineipes** Le Peletier

1845, *Hist. Nat. Ins. Hymén.* **3:** 383.

Dilla, Ethiopia; Accra and Labadi, Gold Coast; Kaffrine, Senegal: 3 ♂♂, 5 ♀♀.

Ammophila punctaticeps Arnold

1919, *Proc. Rhod. Sci. Ass.* **18:** 52.

Tillembeya, River Niger, French Sudan, September 1948, 1 ♀.

Ammophila barbarorum sp. n.

(FIGS. 32, 32*a*)

♀. 21 mm. long. Black. Mandibles excepting the apex, tegulae, the apex of the first tergite above and the whole of the underside, the second tergite and sternite, and the sides of the third tergite ferruginous. Legs ferruginous, excepting the upper side of the fore and middle tibiae and the hind coxae, trochanters, and femora, which are black. The metatarsus of the hind legs and the underside of the scapes fusco-ferruginous. Wings hyaline, slightly tinged with yellow, the apex of the forewing faintly fuscous, the veins brown.

Clypeus, lower half of the face, and the temples with a greyish silvery pubescence, and a long whitish pilosity. Thorax, including the trochanters and the anterior femora, with a similar pilosity, and on the pleura, mesonotum, and sides of the epinotum a yellowish-grey tomentum which does not obscure the sculpture. Head dull, face and clypeus finely and shallowly punctured, the interspaces almost twice as wide as the punctures on the clypeus, upper half of face, and vertex, and about as wide on the lower half of the face. Temples almost impunctate.

Pronotum finely punctured, the dorsum slightly shining. Mesonotum transversely striate, closely punctured between the striae, the sculpture less strong in the middle posteriorly. Scutellum and metanotum closely and longitudinally striate. The pleura finely punctured, less closely than the mesonotum, and with traces of transverse striae on the sterna. Scutate area of the epinotum closely, arcuately, transversely striate, widest across the middle, one-fourth longer than wide at the base. Clypeus feebly convex, two-thirds wider than long, the apical margin convex. Inner orbits barely convergent below. Interocular distance on the vertex equal to the length of the first joints of the flagellum plus one-fourth of the fourth joint. Second joint of the flagellum four times longer than wide at the apex and five-eighths longer than the third. Dorsum of the pronotum about as long as the third joint of the flagellum, very slightly depressed on each side of the middle, but much less widely so than in *dolichocephala* Cameron, three times wider behind than long in the middle, the anterior face nearly vertical, not oblique as in *dolichocephala* Cameron. First joint of the petiole as long as the second, the second tergite conical, nearly twice as long as wide behind. Fifth to sixth tergites with a decumbent and silvery pubescence. The third abscissa of the radius in the type is only one-third as long as the second, and in the paratype even less, so that the second and third transverse cubital veins are almost contiguous on the radius. In the paratype the pronotum is a little shorter than in the type and very feebly depressed on each side of the middle.

Adis Ababa, November 1945, 2 ♀♀.

Related to *dolichocephala* Cameron, from which it may be distinguished by the slope of the pronotum, the much less produced clypeus, and the shorter joints of the flagellum. In *dolichocephala* the second joint of the flagellum is fully five times longer than wide, and the interocular distance on the vertex is equal to the length of the first two joints of the flagellum plus half of the third.

Ammophila caprella sp. n.

(FIGS. 33, 33*a*, and 33*b*)

♂. 23 mm. long. Black. Mandibles excepting the apex, the fore legs, the underside of the middle femora, and the middle and hind tibiae ferruginous; the underside of the hind tibiae blackish in the apical half. The underside of the first tergite (second joint of the petiole), the second tergite and sternite, and the sides of the third tergite fusco-ferruginous. Wings hyaline, the apex faintly fuscous, the veins dark brown.

Face and clypeus with a dense, dull golden yellow pubescence, the temples with silvery pubescence. Head and thorax with an abundant yellowish-grey pilosity, fairly short on the mesothorax and epinotum, long elsewhere. Below the pilosity is a dense, pale yellowish tomentum, obscuring the sculpture except on the dorsum of the thorax. Upper part of the face and the vertex dull, shallowly punctured, closely on the face, with a small area in front of the ocelli impunctate. Thorax dull, the pronotum finely and sparsely punctured, the mesonotum closely punctured and finely transversely striate. Scutellum and metanotum punctured and with a trace of longitudinal striae. Scutate area of the epinotum closely transversely rugose and punctured between the rugae.

Clypeus flat, more than one-third of its length projects beyond the level of the bottom of the eyes, the anterior margin straight. Interocular distance on the vertex equal to the length of the first three joints of the flagellum, and one-fourth greater than interocular distance across the clypeus.

Second joint of the flagellum nearly four times longer than wide and about one-third longer than the third joint. Posterior ocelli nearly twice as far from the eyes as from each other. Pronotal collar very convex transversely and lengthwise, three times wider behind than long in the middle. Scutate area of the epinotum almost parallel-sided, one-fourth longer than wide. First joint of the petiole a little longer than the second. Second tergite three-fourths longer than wide at the apex.

♀. 24 mm. long. Pilosity on the head and thorax not so dense as in the ♂. Clypeus less produced than in the ♂, three-fourths wider than long, the anterior margin feebly convex, and of the same shape as in *barbarorum* ♀.

Posterior ocelli two-thirds farther from the eyes than from each other. Interocular distance on the vertex equal to the length of the first three joints of the flagellum plus one-third of the fourth. Second joint of the flagellum nearly twice as long as the third. Scutate area of the epinotum widened caudad, one-sixth longer than wide. Otherwise like the ♂.

Adis Ababa, April 1948, 1 ♂; Managasha, Ethiopia, November 1945, 1 ♀.

Related distantly to *A. insignis* Smith, race *transvaalensis* Cameron, from which it differs by the long pilosity and colour of the pubescence on the face, and in the ♂ by the clypeus being wider and flat in the apical part, and in both sexes by the much shorter joints of the petiole. The shape of the clypeus in the ♀ also differs considerably from that of *insignis*.

Ammophila argyrocephala sp. n.

(FIGS. 34 and 34*a*)

♀. 19–21 mm. long. Black. Basal half of the mandibles, tegulae, the underside of the petiole, second and third tergites at the base and sides, and the second and third sternites, ferruginous. Legs dark ferruginous, the upper side of the coxae, trochanters, and femora more or less black. Wings hyaline.

Clypeus, face, and temples with a dense silvery pubescence, which on the face appears to end abruptly below the vertex, where the pubescence is much shorter. The temples have in the middle a fringe consisting of a single row of long, white hairs. Thorax with a yellowish-silvery and dense tomentum, obscuring the sculpture on the pleura and epinotum. Pronotum smooth, almost impunctate. Mesonotum indistinctly transversely striate, the striae absent from the disk. Epinotal dorsum closely transversely rugulose.

Clypeus five-sixths wider than long, the apical margin feebly convex. Inner orbits parallel. Interocular distance on the vertex equal to the length of the first two joints of the flagellum plus three-fourths of the third.

Second joint of the flagellum four and a half times longer than wide and fully half as long again as the third. Posterior ocelli nearly one and a half times farther from the eyes as from each other. Pronotal collar four times wider behind as long, the dorsal face merging gradually into the sloping anterior face; seen from the front it is much narrowed dorsad, or broadly triangular with the apex rounded. The pro-pleura have a single row of long hairs. Scutate area of the epinotal dorsum gradually widened from the base to near the apex, then narrowed, one-third longer than wide at the base. First joint of the petiole a trifle longer than the second. Second abscissa of the radius twice as long as the third.

River Errer, May 1948, 1 ♀; Meisso, Ethiopia, September 1945, 2 ♀♀.

Sphex (Parasphex) senegalensis sp. n.

(Fig. 35)

♂. 13 mm. long. Black. This species is so much like *S. lividocinctus* Costa, a north Mediterranean species, that one would be inclined to consider it a subspecies but for the fact that the habitats are separated by the Mediterranean Sea and the Sahara. Kohl's description of Costa's species (1890, *Ann. naturh. Hofmus. Wien,* **5:**339, Pl. VIII, fig. 11) applies in nearly every respect to this species except in the following details:

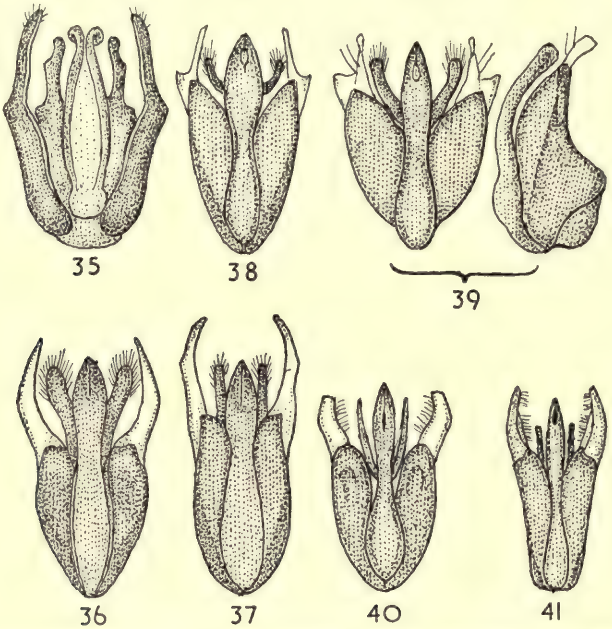


Fig. 35. *Sphex senegalensis*, genitalia, ×21. Fig. 36. *Tachytes basilica*, genitalia, ×18. Fig. 37. *Tachytes guichardi*, genitalia, ×18. Fig. 38. *Tachytes habilis*, genitalia, ×18. Fig. 39. *Tachytes lamentabilis*, genitalia, ×18. Fig. 40. *Tachytes griseola*, genitalia, ×21. Fig. 41. *Tachytes rufitibialis*, genitalia, ×21.

First tergite dark brown, the apical margin of the second to fifth tergites reddish testaceous.

Head and thorax with a long yellowish-white pilosity which on the face, temples, and epinotum is so dense as to hide the underlying sculpture. First tergite with a thin decumbent pubescence of the same colour.

Vertex shining, finely and sparsely punctured. Mesonotum shining, punctured, the interspaces for the greater part two or three times wider than the punctures. Scutellum shining with a few small punctures and distinctly grooved down the middle. Mesopleura closely punctured, the punctures larger than those of the mesonotum. Epinotum closely, transversely, and somewhat arculately rugose, on the dorsum posteriorly also punctate. The proportions of the antennal segments, the interocular distance on the vertex, and the length of the petiole are the same as in *lividocinctus* Costa, also the venation. Claws with four distinct teeth.

Koalack, Senegal, August 1943, 1 ♂.

Sphex (Isodontia) Simoni du Buysson

1897, *Ann. Soc. Ent. Fr.* 356.

Dilla, Ethiopia, April 1948, 1 ♀.

Sphex (Proterosphex) cinerascens Dahlbom

1845, *Hym. Eur.* **1**: 25 and 436.

Labadi, Gold Coast, and Tillembeya, River Niger, French Sudan, April and September, 5 ♂♂, 5 ♀♀.

Sphex (Proterosphex) incomptus Gerstaecker

1871, *Arch. Naturgesch.* **37**: 352.

Aburi, Gold Coast, Dec. 1941, 2 ♀♀; Dilla, April 1948, and River Hawash, Ethiopia, June 1946, 2 ♀♀.

Sphex (Proterosphex) nigrohirtus Kohl

1895, *Ann. Naturh. Hofmus. Wien,* **10**: 66.
S. conradti Berland, 1927, *Bull. Mus. Hist. Nat., Paris,* **1927** (2): 154.

Aburi, Gold Coast, December 1941, 1 ♀.

This specimen agrees in every detail with the description of *conradti*. An examination of the material in the National Museum, Southern Rhodesia, comprising two ♀♀ from Abak, Nigeria, and two ♀♀ from Uganda, shows that the depth of the depression on the clypeus varies, and *conradti* are merely specimens in which it is deep.

Sphex (Proterosphex) haemorrhoidalis Fabricius

1781, *Spec. Insect.* **1**: 443.

This species is given to considerable variation in the colour of the flagellum, clypeus, and legs, all of which may be more or less red instead of black as in the typical form. Four ♂♂ from Aburi, Gold Coast, and Jowaha and River Didessa, Ethiopia, do not diverge from the type, but one ♀ from Aburi has the hind tibiae fusco-ferruginous. Two other ♀♀ from Aburi and Kpeve, Gold Coast, are intermediate between the varieties *volubilis* Kohl and *pulchripennis* Mocsárz.

Sphex (Proterosphex) rufiscutis laevigatus subsp. n.

S. rufiscutis Turner, 1918, *Ann. Mag. Nat. Hist.* (9) **1**: 359.

♀. 19 mm. long. This differs from the typical form as follows. The epinotum has a thin, short, and greyish pilosity, very scanty on the dorsum, and the declivity lacks the decumbent pubescence which, with the pilosity, obscures the sculpture in the type. The sculpture of the dorsum consists of a very close and fine transverse striation only, larger rugae being absent; and is less narrowly caudad. There is a shallow median longitudinal impressed line. The interocular distance on the vertex is greater, being very nearly equal to the length of the first three joints of the flagellum.

The petiole is shorter, being only a little longer than the second joint of the flagellum (in the type of the species equal to the length of the second plus half of the third). The pronotal collar is shorter and flatter.

Near Sofara, French Sudan, September 1944, 1 ♀.

Possibly a distinct species, but in the absence of the ♂ it is best to treat it as a subspecies.

Subfamily LARRINAE

Genus **Tachytes** Panzer

The collection contains a number of species of which a large proportion are represented by only one sex, and by specimens which are defective, for which reason they cannot be described although apparently new species. In all the collections which I have seen, the males outnumber the females. The reason is that the former are, by their habits, much more conspicuous. They visit flowers far more frequently than the females, and when not so occupied are in the habit of sunning themselves in a particular spot to which they return again and again if disturbed. The females make their burrows more often in hard soil, such as, for example, native foot-paths, than in loose sand. I cannot recall ever having found them nesting in the sandbanks of rivers, which are favourite nesting-sites for *Bembix.* The great differences in the length of the tongue and galea amongst the species might lead one to suppose that they are oligotropic, but this supposition cannot be maintained in view of the fact that species with those organs short, medium, and long have been taken visiting the same flowering bushes, such as *Combretum* and *Zisyphus.*

Tachytes observabilis Kohl

1894, *Ann. naturh. Hofmus. Wien,* **9:** 295.

Lake Anasa, Ethiopia, April 1948, 1 ♂.

Tachytes basilica Guérin

(FIG. 36)

1844, *Icon. règne anim.:* 440.

Tillembeya, River Niger, French Sudan, September 1944, 1 ♂.

Tachytes guichardi sp. n.

(FIG. 37)

♂. 13 mm. long. Black. Abdomen flavo-ferruginous, the anterior face of the first tergite and the greater part of the middle of the first three sternites blackish. Tibiae and tarsi pale reddish-brown. Wings hyaline, slightly yellow, the apex beyond the cells pale brown. Head, thorax, and base of first tergite with yellowish pilosity. Tergites with a pale yellow decumbent pubescence arranged in a chequered pattern as in the *basilica* group. Vertex, mesonotum, and scutellum very finely punctured, the interspaces barely larger than the punctures. Epinotum and mesopleura very finely reticulate-punctate. Sternites moderately shining, very finely and closely punctured.

Galea more than two and a half times longer than the scapes. Second joint of the flagellum three times longer than wide, the three to six joints moderately arcuate below.

Interocular distance on the vertex a little shorter than the second joint of the flagellum. Dorsum of the epinotum about one and a half times wider at the base than long. Seventh tergite trapezoidal, the apical margin wide and feebly convex. Basal joint of anterior tarsi with five to six spines. The outer paramera of the genitalia densely villose below, the membranous apical portion narrow and very long.

Dakar, Senegal, August 1943, 1 ♂.

Allied to *neavei* Turner from which it differs by the wider vertex and the flavo-ferruginous abdomen. In the colour of the abdomen it resembles *basilica* Guérin, which, however, is a larger insect with a shorter galea.

Tachytes dilaticornis Turner

1917, *Ann. Mag. Nat. Hist.* (8) **20:** 23.

Jowaha, N. of Debra Sina, 6,000 ft., Ethiopia, August 1946, 1 ♂.

Tachytes hamiltoni Turner?

Loc. cit., *supra*: 17.

♀. 15 mm. long. This is probably the hitherto undescribed ♀ of this species. The pilosity and pubescence of the head and thorax is brassy golden. The femora, excepting the basal half of the middle pair, are flavo-ferruginous. First four tergites with apical fasciae of silvery pubescence, the fifth and the sides of the fourth with a preapical row of long, porrect, and brown setae, the pygidial area with dark coppery pubescence. Second sternite over the basal two-thirds dull and microscopically, closely punctured, the apical third, like the following sternites, smooth, shining, and with a few large setigerous punctures. Interocular distance on the vertex very little shorter than the second joint of the flagellum, the latter three times longer than wide. Galea as in the ♂, twice as long as the scapes. Basal joints of the anterior tarsi with six spines on the outer margin, the pubescence on the middle and hind tibiae golden.

Accra, Gold Coast, July 1946, 1 ♀.

The type of the species, a ♂, was taken in British East Africa, so this ♀ may perhaps be a distinct species, but the main characters suggest that the identification is correct.

Tachytes habilis Turner

(FIG. 38)

Loc. cit., *supra*: 35.

Koundé-Saré, French Sudan, August 1945, 4 ♂♂.

The locality of the type of the species is near Fort Johnstone, Nyasaland.

Tachytes versatilis Turner

Loc. cit., *supra*: 34.

Moggio, Ethiopia, April 1948, 1 ♂.

Tachytes neglecta Turner

Loc. cit., *supra*: 32.

Tillembeya, River Niger, French Sudan, September 1944, 1 ♂.

The genitalia resemble those of *habilis* Turner, but the apical portion of the outer paramera are dilated, or spoon-shaped, and not parallel-sided as in that species.

Tachytes lamentabilis sp. n.

(FIG. 39)

♂. 14 mm. long. Black. Face and clypeus with pale golden pubescence and pilosity. The rest of the head, the thorax, and base of first tergite with dull yellow pilosity, short on the mesonotum. First four tergites with apical fasciae of grey pubescence, sternites 2–4 with narrow, thin, and yellowish-grey apical fasciae, the fifth and sixth with brown fasciae. The seventh tergite closely punctured and with fulvous pubescence. Wings flavo-hyaline, without any apical infuscation, the veins brown. Vertex with a few small and shallow punctures. Dorsum of thorax closely and microscopically punctured. Second sternite shallowly and sparsely punctured in the middle, more closely and very finely at the sides, the following sternites closely and strongly punctured in the apical half, the basal half smooth and shining. Galea half as long again as the scapes. Clypeus subcarinate lengthwise in the middle. Interocular distance on the vertex equal to the length of the first two joints of the flagellum. The second joint is only twice as long as wide. Dorsum of the epinotum short, as long as the scutellum. Seventh tergite subtriangular, the apex narrowly truncate. Basal joints of the anterior tarsi with six spines.

♀. 16 mm. Clypeus very convex lengthwise, but not subcarinate. Galea as long as the scape. Interocular distance on the vertex equal to a little more than the length of the second joint of the flagellum. The latter nearly three times longer than wide. Otherwise like the ♂.

Aburi, Gold Coast, December 1941, 1 ♂, 1 ♀.

Owing to the scanty pilosity and pubescence this species looks very different from the other species of the genus. To the naked eye, it looks more like some of the larger species of *Liris* (*Motes*) of the *sepulchralis* group.

Tachytes compacta sp. n.

♀. 12–14 mm. long. Black. First tergite at the sides and on the apical margin, the apical margin of the second tergite, the base of the second sternite, and apical margin of the third sternite, somewhat reddish.

Clypeus, face, temples, and the thorax with a dense, pale brassy pubescence, that of the thorax paler or almost silvery, and very dense on the pleura. The long erect pilosity present in most species of the genus is absent. First four tergites and sternites with apical faciae of yellowish-grey pubescence, the pygidial area with a dense, fine, and golden pubescence.

Extreme apex of the hind femora and the basal third of the hind tibiae with pale golden pubescence, the apical two-thirds with silvery pubescence. Wings short, hyaline, the veins ochreous. Puncturation of the vertex and thorax and second sternite close and microscopic, the second sternite dull except on the apical margin, the third to fifth sternites shining and very sparsely punctured, but with the apical fourth dull and finely punctured, the sixth shining, sparsely and fairly coarsely punctured. Galea shorter than the scape. Apical margin of the clypeus narrowly reflected. Interocular distance on the vertex equal to the length of the second joint of the flagellum plus half of the first. Epinotal dorsum as long as the scutellum. Basal joint of the anterior tarsi with six yellow spines on the outer margin.

Kaffrine, Senegal, August 1943, 2 ♀♀.

Closely related to *T. erynnis* Turner, from which it differs by the colour of the pubescence, the absence of pilosity, the colour of the first two abdominal segments, and the shining third sternite. The smaller specimen has the first two tergites paler, or yellowish-red.

Tachytes fucata sp. n.

♀. 15 mm. long. Head and thorax black, abdomen ferruginous, the base of the third and fourth tergites, the whole of the fifth, black. The middle and apical margin of the fourth and fifth sternites and the whole of the sixth blackish. Legs ferruginous, the upper side of the fore and middle femora blackish, the posterior coxae and trochanters fusco-ferruginous. Wings clear hyaline, the veins ochreous. Pubescence on the head and thorax dense, yellowish-silvery, on the pleura and sterna silvery, the face and epinotum also with a short, exserted whitish pilosity. First four tergites with apical fasciae of silvery pubescence. Sternites shining, the puncturation microscopic. The pygidium elongate triangular, four-fifths longer than wide at the base, clothed with dark golden pubescence.

Galea half as long as the scape. Interocular distance on the vertex equal to very little more than the length of the second joint of the flagellum; the second joint two and one-third times longer than wide at the apex. The erect pilosity on the dorsum of the epinotum is confined to the sides, which gives a false impression of that part having a median triangular field. Basal joint of the anterior tarsi with five spines on the outer margin.

Aleg, S. Mauritania, September 1943, 1 ♀; Tillembeya, River Niger, French Sudan, August 1944, 1 ♀.

Possibly related to *T. sjöstedti* Cameron, but that species has only the three basal abdominal segments red, and the abdomen much broader at the base, or conical, whereas in this species it is lanceolate. The specimen from Tillembeya has the wings slightly tinged with yellow, and the third and fourth abdominal segments less stained with black.

Tachytes griseola sp. n.

(FIG. 40)

♂. 7·5–8·5 mm. long. Black. Tarsi brownish-ochreous, the apical joint paler. Sixth to ninth joints of the flagellum red below. Wings hyaline, the veins and the tegulae pale ochreous. Clypeus and face with a silvery pubescence and a scanty grey pilosity. Thorax with a sparse decumbent pubescence and a long, white pilosity, longest on the sides of the thorax and epinotum. The anterior and middle femora also with the same and dense pilosity. Abdomen with a fairly long, adpressed greyish pubescence, directed inwards on the basal half of the tergites and outwards on the apical half, where it is denser and forms transverse fasciae. Seventh tergite with silvery pubescence. Vertex, mesonotum, and scutellum very finely and closely punctured (30 diameters), the dorsum of the epinotum closely and somewhat obliquely rugulose-recticulate (16 diameters). The declivity dull, closely and transversely striolate. Sternites shining, the second closely and finely punctured, the following segments more coarsely and less closely.

Galea shorter than the scape. Vertex wide, the interocular distance at the base of the eyes being only two and a half times greater than on the vertex, where it is equal to very little more than the length of the first two joints of the flagellum. The second joint of the flagellum is short, being not quite twice as long as wide at the apex.

Dorsum of the epinotum as long as the scutellum and metanotum united. Basal joint of the anterior tarsi with three spines on the outer margin.

♀. 10 mm. long. The extreme apical margins of the first five abdominal segments fusco-ferruginous. Pygidial area clothed with a dark golden pubescence. Second sternite fairly dull, closely and microscopically punctured. Interocular distance on the vertex equal to the length of the first two joints of the flagellum. Basal joint of the anterior tarsi with five white spines on the outer margin. Otherwise like the ♂.

Labadi, Gold Coast, March 1941, 5 ♂♂, 1 ♀; Ufdem, Ethiopia, August 1945, 1 ♂, 1 ♀. These are a little larger than the specimens from the Gold Coast, ♀, 10 mm., 1 ♀, 10·5 mm. long.

This species and the one described below belong to a group of small *Tachytes* in which the tarsi are pale reddish-yellow and the vertex is wide. It includes *T. lepida* Arnold, *T. nigroannulata* Bischoff, and *T. silverlocki* Turner, from all of which it differs by the genitalia.

Tachytes rufitibialis sp. n.

(FIG. 41)

♂, 7·5–9 mm. long. Closely related to preceding species, *T. griseola*, from which it differs as follows. Third to ninth joints of the flagellum dark brown above, reddish-yellow below. Apices of the femora and the tibiae reddish-yellow, like the tarsi. Pubescence on the clypeus and face pale golden. Pubescence and pilosity on the thorax yellowish-grey. Tergites 1–4 with yellowish-grey fasciae covering the apical third of the segments, the basal portion with only a microscopic black pubescence.

Sculpture of the epinotum like that of *griseola*, but stronger, the declivity moderately shining.

Interocular distance at the base of the eyes two and a third times greater than on the vertex, where it is equal to the length of the first two joints of the flagellum plus one-fourth of the third.

Pygidial area more rounded at the apex, covered with pale golden pubescence. Outer paramera of the genitalia with the apical portion more acute, not bluntly angular on the outer margin but evenly convex. Otherwise like *griseola*.

Tillembeya, River Niger, French Sudan, August 1944, 5 ♂♂.

Tachytes discrepans sp. n.

(Fig. 42)

♂. 9·5 mm. long. Black. Face and clypeus with silvery pubescence. Thorax with a scanty yellowish-grey pubescence, the spinotum also with a sparse pilosity of the same colour. Wings hyaline, the veins ochreous. Tergites 1–4 with apical fasciae of grey pubescence, the seventh tergite with silvery. Vertex and dorsum of the thorax very finely recticulate-punctate. Sternites not quite dull, very finely punctured, the second, third, and fourth with a thin greyish pubescence, more abundant on the apical margins, forming fasciae. Anterior margin of the clypeus produced into a very short lobe over the median fourth. Galea shorter than the scape.

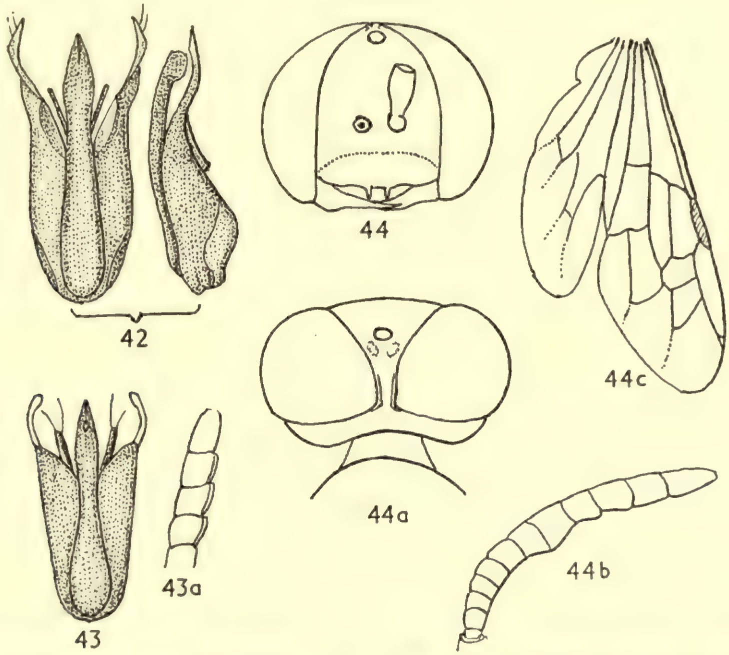


Fig. 42. *Tachytes discrepans*, genitalia, × 27. Fig. 43. *Tachytes falcigera*, genitalia, × 18. Fig. 43*a*. *Tachytes falcigera*, apical joints of the flagellum, × 18. Figs. 44 and 44*a*. *Odontosphex bidens* ♂, head, × 18. Fig. 44*b*. *Odontosphex bidens* ♂, flagellum, × 27. Fig. 44*c*. *Odontosphex bidens* ♂, wings, × 12.

Ninth, tenth, and eleventh joints of the flagellum compressed dorso-ventrally on their inner halves and strongly carinate on the inner margin, the second joint twice as long as wide at the apex.

Interocular distance at the base of the eyes five-sevenths wider than on the vertex, where it is equal to the length of the first two joints of the flagellum. Anterior metatarsi with four white spines on the outer margin. Apical portion of the outer paramera of the genitalia very thin, lamelliform, twisted, and slightly dilated close to the apex.

♀. 10 mm. long. Tarsi, excepting the basal joint, fusco-ferruginous. Pubescence and pilosity on the head and thorax yellowish-silvery, on the underside of the fore and middle femora silvery. Tergites 1–4 with a thin greyish pubescence on the basal part, and with broad apical silvery fasciae.

Pygidial area with golden pubescence. Second sternite dull, microscopically punctured, the remaining sternites shining, fairly coarsely and very sparsely punctured. Interocular distance on the vertex slightly less than the length of the first two joints of the flagellum. The second joint of the latter two and a half times longer than wide, the ninth to eleventh joints not dilated nor carinate. Anterior margin of the clypeus without a median lobe, otherwise like the ♂.

Kaolack, Senegal, August 1943, 1 ♂, 1 ♀.

The ♂ differs from all the other African species in the shape of the genitalia and, excepting *instabilis* and the following species, by the ninth to eleventh joints of the flagellum. The ♀ resembles *T. silverlocki* Turner and *T. disputabilis* Turner, from both of which it can be distinguished by the colour of the pubescence on the sixth tergite, the sculpture of the thorax, particularly of the epinotal dorsum, and by the number of spines on the outer margin of the anterior matatarsi. From *instabilis* Turner ♀ it may be distinguished by its smaller size and wider vertex, which in *instabilis* is equal to only the length of the second joint of the flagellum.

Tachytes falcigera sp. n.

(FIGS. 43, 43*a*)

♂. 14 mm. long. Black. Wings hyaline, and faintly tinged with yellow, the veins ochreous. Face and clypeus with yellowish-silvery pubescence. Thorax with a rather sparse yellowish-grey pubescence, and on the epinotum with a sparse pilosity of the same colour. Tergites 1–4 with apical fasciae of silvery pubescence, the seventh with yellowish silvery.

Vertex, mesonotum, and scutellum very closely and finely punctured, the following sternites shining, sparsely and coarsely punctured. Galea a little more than half as long as the scapes. Anterior margin of the clypeus flattened.

Interocular distance at the base of the eyes twice as great as on the vertex, where it is equal to the length of the second joint of the flagellum. The second joint is two and a third times longer than wide at the apex, and the ninth to eleventh joints are compressed on their inner halves and carinate, as in the preceding species.

Dorsum of the epinotum a little shorter than the scutellum and metanotum united. Anterior metatarsi with five white spines on the outer margin. Outer paramera of the genitalia abruptly attenuated apically, the attenuated part sickle-shaped and slightly widened at the apex, the inner rod-shaped paramera emit two long and thin hairs at the apex.

Aleg, S. Mauritania, September 1943, 1 ♂.

In my key to the species (1923, *Ann. Transv. Mus.* **9**) this runs down close to *T. instabilis* Turner, but the interocular distance is shorter than in that species. The genitalia of the specimen from Willowmore, Cape Province, which I identified as *instabilis*, are quite unlike those of *falcigera*, resembling those of *T. bulawayoensis* Bischoff.

Tachytes seminuda sp. n.

♀. 10·5 mm. long. Black. First two abdominal segments and the third excepting the apical margin red. Last three joints of the anterior tarsi and apical joint of the lower and hind tarsi, ferruginous. Wings hyaline, the veins pale brown. Clypeus and sides of the face and the bottom of the temples with a short and by no means dense silvery pubescence. On the thorax there is a little grey pubescence on the lateral margins of the mesonotum and on the epinotum, but the outstanding pilosity present in nearly all other species of the genus is absent.

The first three tergites have inconspicuous apical fasciae of silvery pubescence, and the pygidial area has dark golden pubescence. Vertex microscopically and closely punctured (30 diameters), the mesonotum closely and transversely rugulose (25 diameters), the dorsum of the epinotum reticulate-punctate and obliquely striate at the sides of the base (30 diameters). Second sternite dull, the third and following sternites shining, with a few large punctures near the apical margin. The abdomen is widest in the middle, or lanceolate, instead of being obconical or widest across the basal segment, as in the other species of the genus.

Galea less than half as long as the scapes. Eyes widely divergent below, the interocular distance at the base of the eyes being very nearly three and a half times greater than on the vertex, where it is equal to the length of the second joint of the flagellum.

Clypeus short, nearly four times wider than long. Flagellum slender, the second joint fully two and a half times longer than wide at the apex, all the following joints at least twice as long as wide. Second to fifth sternites and the fifth tergite with a row of brown setae on the apical margin. Anterior metatarsi with five yellow spines on the outer margin. Pygidial area triangular, longer than wide at the base.

Tillembeya, River Niger, French Sudan, August 1944, 2 ♀♀.

This species differs from all the others known to me by the paucity of pubescence and pilosity, and the shape of the abdomen. Superficially it looks much more like a *Tachysphex*, e.g. *T. miniatulus* Arnold, than a *Tachytes*.

PHYTOSPHEX gen. n.

Characters

♀. Anterior tarsi without a comb, the metatarsus with a few small spines on the underside and at the apex. Hind tibiae and metatarsi with a row of long spines on the upper side. Pygidium without a marginate dorsal face.

♂. Anterior metatarsi without long spines on the outer margin, the hind tibiae and metatarsi as in the ♀. In both sexes the vertex is wide, the eyes not being strongly convergent above as in *Tachysphex*, and the sculpture of the head and thorax is strong, consisting of large and widely spaced punctures on the head and thorax, and a coarse reticulation on the epinotum. Anterior margin of the clypeus produced in the middle into an acute, wide, and triangular tooth. Otherwise like *Tachysphex*.

Genotype: *Tachysphex turneri* Arnold.

Not only does this species differ from *Tachysphex* in the sculpture, but the nesting habits are, according to the late Dr. Brauns's observations, totally different. Instead of burrowing in the ground, it nests in hollow stems of *Aloe*, *Datura*, &c., and the partitions between the cells are formed of earth and little pebbles.

Phytosphex turneri Arnold

1923, *Ann. Transv. Mus.* **9**: 165.

A slight variety, differing from the type of the species in having the second to fourth tergites blackish in the middle and on the apical third of the segments.

Adis Ababa, Ethiopia, April 1948, 1 ♀.

ODONTOSPHEX gen. n.

Characters

♂. Mandibles not excised on the outer margin. Clypeus short, not longer than the distance between its hind margin and the antennal sockets, the anterior margin with two long and thin teeth near the middle. Eyes strongly convergent above, the vertex narrower than the anterior ocellus. Posterior ocelli oval, flattened, and almost obsolete. Second to seventh joints of the flagellum short, wider than long, the seventh and tenth swollen behind. Dorsum of the pronotum linear, lying well below the level of the mesonotum. Episternal suture absent. Dorsum of the epinotum with a defined and broad median area. Eighth sternite emarginate and bidentate. Anterior tarsi without cilia or spines. Middle tibiae with two calcaria, the inner one very small. Posterior tibiae and tarsi without long spines on the upper side, the tibiae with a row of very short spines hardly longer than the pubescence. Forewings with three cubital cells, the third less than twice as long on the cubitus as on the radius, the second receiving both recurrent veins. Hindwing: the cubitus emitted well before the end of the submedial cell.

Genotype: *O. bidens.*

The genus is remotely related to *Tachysphex*, from which it differs, *inter alia*, by the venation, the absence of the episternal suture, and the form of the flagellum.

Odontosphex bidens sp. n.

(FIGS. 44, 44*a–c*)

♂. 6 mm. long. Black. Middle third of the mandibles rufescent. Flagellum ochreous, the first four joints slightly infuscated. Apical margins of the abdominal segments testaceous. Tibiae, tarsi, and the hind femora pale reddish-ochreous. Wings hyaline, tegulae and pterostigma pale yellow, the veins pale brown. Clypeus and face up to the anterior ocellus, temples, underside of the anterior femora, sides and anterior angles of the mesonotum, mesopleura, and base of the epinotal dorsum, covered with silvery pubescence. A small patch of similar pubescence on each side of the scutellar and metanotal disks.

Sides of the epinotum, and the declivity excepting the middle, with exserted and fairly dense silvery pilosity. Abdomen with a very fine, grey, and decumbent pubescence, and on the apical margins of the first five tergites fasciae of silvery pubescence. Face, from the antennal sockets to the anterior ocellus, dull, microscopically and closely punctured, slightly convex but without any swellings. Ocellar area and vertex shining, sparsely punctured. On the vertex a carinula on each side margins the eyes.

Mesonotum, scutellum, and metanotum shining, finely punctured, the interspaces three or four times wider than the punctures, except on the posterior fourth of the mesonotum and on the metanotum, where they are smaller. Mesopleura dull, closely punctured (35 diameters), a short transverse crest extends from the hind margin forwards, just above the middle coxae. Dorsum of the epinotum nitidulous, a little more strongly and more closely punctured than the scutellum, the margins of the median area indicated by a narrow depressed line. A median carina extends from the base to near the apex of the area. Declivity dull, with a wide pit below the brow. Metapleura and sides of the epinotum fairly dull, closely punctured (45 diameters). Tergites and sternites almost dull, very closely and finely punctured (30 diameters). Head wider than the thorax. Clypeus five times wider than long, the anterior margin feebly convex and with an acute tooth, longer than wide at the base, on each side of the middle. Eyes strongly divergent below, the interocular distance across the base of the clypeus being eight times greater than across the vertex, where it is equal to the length of the second joint of the flagellum. First joint of the flagellum very small, not globose, the second joint three-fourths wider than long, the first to seventh wider than long, the seventh to tenth swollen below, the apical joint one and a half times longer than wide. Scutellum twice as wide as long, dorsum of the epinotum about three times wider at the base than long, as long as the scutellum, the junction with the subvertical declivity rounded. First tergite about one and a half times wider behind than long.

Basal joint of the anterior tarsi thin and very long, as long as the remaining joints united.

Hind femora and tibiae slightly compressed transversely, the tibiae with a row of about twelve very small scalariform teeth on the upper margin (45 diameters), apical margin of seventh tergite transverse. First abscissa of the radius slightly shorter than the third, and a little longer than the second.

Aleg, S. Mauritania, September 1943, 1 ♂.

Tachysphex fluctuatus Gerstaecker

1857, *Mber. Akad. Wiss. Berl.*: 510.
Arnold, 1945, *Sphecidae of Madagascar*: 97.

Labadi, Gold Coast, March 1941, 1 ♂; Meisso, Ethiopia, September 1945. The second specimen has the epinotum much more strongly and more widely reticulate, and more pilose than in the typical form.

Tachysphex bruneiceps Arnold

1923, *Ann. Transv. Mus.* **9**: 153.

River Hawash, Ethiopia, June 1946, 1 ♀.

Tachysphex egregius Arnold

1924, *Ann. Transv. Mus.* **11**: 273 ♂.
1929, *Ann. Transv. Mus.* **13**: 384 ♀.

Labadi, Gold Coast, May 1941, 1 ♂, 1 ♀; Tillembeya, River Niger, French Sudan, August 1944, 1 ♀.

Tachysphex theseus sp. n.

(FIG. 45)

♀. 10 mm. long. Black. Apical margin of the fourth and the whole of the fifth and sixth abdominal segments ferruginous. Tarsi ferruginous, the apical joints a little darker. Wings hyaline, the veins pale brown. Face and clypeus with pale golden pubescence, thorax with a very short, sparse, and grey pubescence. Clypeus and face dull, very finely and closely punctured, the vertex nitidulous and not quite so closely punctured as the face, the temples smooth and shining.

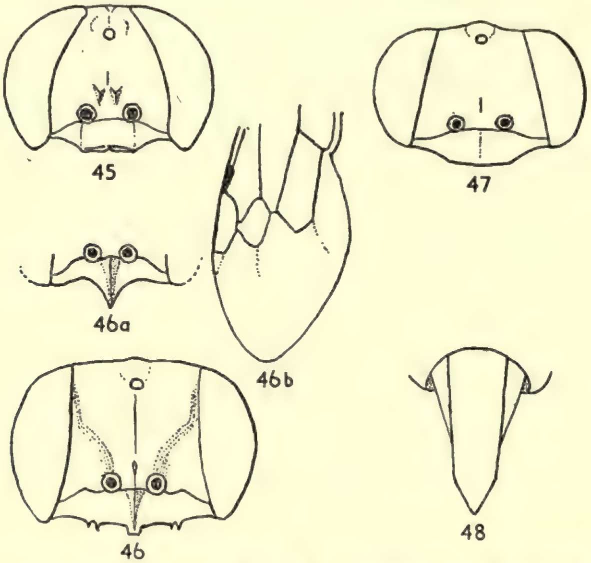


FIG. 45. *Tachysphex theseus* ♀, ×*c.* 10. FIG. 46. *Gastrosericus fluviatilis* ♀, ×16. FIG. 46*a*. *Gastrosericus fluviatilis* ♂, clypeus, ×16. FIG. 46*b*. *Gastrosericus fluviatilis* ♀, wing, ×*c.* 10. FIG. 47. *Gastrosericus senegalensis* ♀, ×16. FIG. 48. *Palarus rothschildi croesus* ♀, pygidium, ×10.

Mesonotum shining, punctured, the punctures about twice as large as those on the face, the interspaces from two to three times wider than the punctures, except on the margins which are very closely punctured. Scutellum and metanotum shining, their puncturation a little smaller on the face. Mesopleura finely and very closely punctured. Dorsum and declivity of the epinotum dull, fairly closely reticulate, the sides of the epinotum shining, transversely striate. Abdomen dull, impunctate, the pygidial area twice as long as wide at the base, the apex narrowly truncate.

Median area of the clypeus nearly twice as wide as long, impressed behind the anterior margin which is feebly concave in the middle. Supra-antennal tubercles prominent. Interocular distance on the vertex very nearly as long as the first two joints of the flagellum. Behind the ocellar area there is a well-defined angular depression. Flagellum slender, the second joint nearly three times longer than wide at the apex, the third joint a little longer than the second. Dorsum of the epinotum two and two-fifths wider at the base than long. Fourth joint of all the tarsi very short, wider than long, the claws asymmetrical, the outer claw of the anterior tarsi larger than the inner, and smaller than the inner of the middle and hind tarsi.

Accra, Gold Coast, September 1941, 1 ♀.

Related to *T. hippolyta* Arnold and *T. harpax* Arnold and having the claws asymmetrical as in them, but differing from both by the length and sculpture of the epinotum, the slender flagellum, and the colour of the apical abdominal segments.

Tachysphex panzeri van der Linden var. **aethiopicus** Arnold

1923, *Ann. Transv. Mus.* **9**: 167.

Labadi, Gold Coast, March 1941, 3 ♂♂.

Atelosphex lugubris Arnold

1924, *Ann. Transv. Mus.* **11**: 72.

Accra, Gold Coast, September 1941, 1 ♀.

This differs to a slight degree from the type of the species, but hardly enough to justify a varietal name. The puncturation of the mesonotum in the middle is sparser, the dorsum of the epinotum is more reticulate, and the pygidial area is narrower. In the coarse puncturation and the absence of spines along the length of the hind metatarsi, the genus shows some affinity with *Phytosphex* Arnold, but in the latter the epicnemial suture is present.

Parapiagetia capensis Brauns var. **ferox** Arnold

Brauns, 1910, *Dtsch. ent. Z.*: 666.
Arnold, 1922, *Ann. Transv. Mus.* **9**: 135.

Ufdem, Ethiopia, August 1945, 1 ♀; Aleg, S. Mauritania, September 1943, 1 ♀, Dakar, Senegal, August 1943, 1 ♀.

The specimen from Dakar is a slight variety, having the last three abdominal segments blackish.

Gastrosericus neavei reversa subsp. n.

G. neavei Turner, 1913, *Trans. Ent. Soc. Lond.*: 754.

♀. 8 mm. long. The corners of the median lobe of the clypeus are not rectangular as in *neavei* i. sp. but produced into blunt teeth, and the wings are slightly darker. Otherwise it does not differ except in one very remarkable character in which it also differs from all other Ethiopian Sphecids known to me.

In *neavei* i. sp. the dorsum of the epinotum is glabrous, but in this race on each side of the median transversely rugose area there is a coarse, obliquely exserted and silvery pubescence, directed *cephalad*. In the ♂ this pubescence is less abundant, but plainly apparent if the insect is looked at caudad. Otherwise like the type of the species.

Tillembeya, River Niger, French Sudan, August 1944, 4 ♀♀, 4 ♂♂.

Gastrosericus fluviatilis sp. n.

(FIGS. 46, 46*a* and 46*b*)

♀. 8 mm. long. Black. The following parts pale yellow: basal half of the mandibles, the apex of the scapes, tegulae, apical half of the anterior femora, apical third of the middle and extreme apex of the hind femora, tibiae and first two joints of tarsi, the last three joints pale ferruginous. Wings hyaline, faintly smoky, the veins brown. Clypeus, lower half of the face, temples, dorsum of the pronotum, mesosterna, and lower half of the mesopleura with silvery pubescence. Epinotum with short, erect and white pubescence. Tergites 1–4 with apical fasciae of grey pubescence, the pygidial area with dark golden pubescence. Sternites 3–6 shining and impunctate, the rest of the body dull, closely and microscopically punctured, the largest punctures being on the scutellum and epinotum (30 diameters). Clypeus short, five times wider than long, carinate lengthwise in the middle, and with a very short lobe on the anterior margin; between the lobe and the lateral angles there are two small teeth on each side. Interocular distance at the base of the eyes two-thirds greater than across the vertex, where it is equal to the length of the first five joints of the flagellum. Temples with a triangular tooth near the middle.

Second joint of the flagellum slightly shorter than the third and not quite twice as long as wide. Lower third of the face excavated, the upper margin of the excavated area continued as a groove margining the eyes as far as the level of the anterior ocellus.

Propleura with a transverse torus on each side in front of the hind margin. Anterior coxae triangular, the anterior margin raised and thickened. Pronotal collar barely as long as the first joint of the flagellum and lying much below the level of the mesonotum. Dorsum of the epinotum fully twice as wide at the base as long, joining the oblique declivity in a wide curve. First tergite a little longer than wide at the apex, and like the second tergite a little swollen in front of the hind margin. Pygidial area elongate-triangular, slightly shining and sparsely punctured at the base. Anterior metatarsi with six short spines on the outer margin. Second discoidal cell petiolate, the first abscissa of the radius fully three times longer than the second.

♂. 6 mm. long. Middle and hind tibiae with a fuscous macula on the inner side, the last four joints of the hind tarsi black. Pubescence on the clypeus and face golden. Clypeus produced in the middle into an acute tooth. Joints of the flagellum very short, the second one and a half times longer than wide. Temples without a tooth, anterior coxae less thickened in front than in the ♀. Otherwise like the ♀.

Tillembeya, River Niger, French Sudan, August 1944, 1 ♂, 6 ♀♀.

Related to *turneri* Arnold, from which it differs, *inter alia*, by the shape of the clypeus and anterior coxae, the much finer puncturation of the thorax, and the venation.

Gastrosericus senegalensis sp. n.

(Fig. 47)

♀. 6·5 mm. long. Head and thorax black, abdomen pale ferruginous. Mandibles yellow at the base, the apex of the scapes ochreous on the upper side. Femora fusco-ferruginous, the fore and middle pairs yellow at the apex, tibiae and tarsi pale ferruginous, the tibiae pale yellow on the upper side. Wings hyaline, the veins ochreous. Head and thorax with a very short adpressed and yellowish-silvery pubescence, without any long pilosity. Tergites with a thin and microscopic greyish pubescence. The whole body dull and, excepting the pygidial area, very closely and microscopically punctured (50 diameters), the dorsum of the pronotal collar with traces of transverse rugulosity. Pygidial area shining, sparsely punctured, twice as wide at the base as long.

Clypeus three times wider than long, subcarinate in the middle, the anterior margin convex and without teeth. Eyes divergent below, the interocular distance at their base half as great again as across the vertex, where it is equal to the length of the first three joints of the flagellum plus half of the fourth. The second joint about twice as long as wide, and as long as the third. Temples unarmed. Dorsum of the pronotum narrowed anteriorly, fairly long, as long as the first joint of the flagellum. Dorsum of the epinotum twice as wide at the base as long, with a very indistinct basal triangular area. Anterior metatarsi with five long spines on the outer margin. First abscissa of the radius twice as long as the second, the recurrent veins contiguous on the second cubital cell.

Dakar, Senegal, August 1943, 1 ♀.

Smaller than the Egyptian *G. waltii* Spinola and without the long pubescence on the head and thorax and rugose sculpture of the epinotum present in that species. It differs from *G. capensis* Brauns in the much finer sculpture and dull surface of the head and thorax and by the absence of a long and woolly pubescence on those parts.

Liris (subgen. **Motes**) **nugax** Kohl

1894, *Ann. naturh. Hofmus. Wien*, **9**: 302.

Dilla, Ethiopia, April 1943, 1 ♀; Didessa River, Ethiopia, June 1946, 1 ♀.

Liris (Motes) croesus Smith

1856, *Cat. Hymen. B.M.* **4**: 284.

Diafarabé, Senegal, August 1944, 1 ♂.

Liris (Motes) solstitialis Smith

1856, *Cat. Hymen. B.M.* **4**: 283.

Aburi and Accra, Gold Coast, August to September 1941, 1 ♂, 1 ♀.

Liris (Motes) rugifera Turner

1918, *Ann. Mag. Nat. Hist.* (9), **5**: 362.

Accra, Gold Coast, September, 1 ♀.

Liris (Motes) thysanomera Kohl

1894, *Ann. naturh. Hofmus. Wien*, **9**: 302.

Accra and Aburi, Gold Coast, December 1941, 3 ♀♀.

Liris (Motes) antaca transvaalensis Cameron

Arnold, 1945, *Sphecidae of Madagascar*: 126.

Adis Ababa and River Hawash, Ethiopia, August and June, 2 ♀♀.

Liris (Motes) egregia Arnold

1929, *Ann. Transv. Mus.* **13**: 395.

Adis Ababa and Dilla, Ethiopia, June, 2 ♂♂.

Liris (Motes) setigera Arnold

1940, *Ann. Transv. Mus.* **20**: 123.

Tillembeya, River Niger, French Sudan, August 1944, 1 ♂.

Liris (Motes) denticulata Turner

1920, *Ann. S. Afr. Mus.* **17**: 496.

Accra and Labadi, Gold Coast, September and March 1941, 2 ♀♀.

These represent a slight variety in which the tarsi are ferruginous instead of brownish-black.

Liris (Motes) flavitincta Arnold

1940, *Ann. Transv. Mus.* **20**: 141.

Accra, Gold Coast, September 1941, 1 ♀.

Liris (Motes) abyssinica Arnold

1933, *Ann. Mag. Nat. Hist.* (10) **77**: 353.

Fiché, Ethiopia, October 1945, 1 ♂.

Liris (Motes) gracilicornis Arnold

1923, *Ann. Transv. Mus.* **9**: 250.

Labadi, Gold Coast, March 1941, 1 ♀.

Liris nigricans Walker race **reticulata** Saussure

1871, *List Hymen. Egypt*: 21.
Arnold, 1945, *Sphecidae of Madagascar*: 132.

Dilla, Ethiopia, April 1948, 2 ♂♂.

Palarus rothschildi croesus subsp. n.

(Fig. 48)

P. rothschildi Magretti, 1908, *Bull. Mus. Hist. Nat. Paris*: 189, ♂.

The insect described hereunder agrees in the main with the description of *rothschildi*, but there are differences in structure as well as in colour. Not much importance attaches to the latter, and since it appears to me improbable that Magretti overlooked the structural characters it seems more prudent to treat this as a subspecies.

♂. 9·5 mm. long. The yellowish-white markings on the scutellum are confined to the posterior angles, the epinotum is entirely black, the pale maculae on the tergites are present on the fifth and sixth as well as on the four basal tergites. Mesopleura without any transverse striation. Excepting a small round and smooth area in front of the hind margin, the whole of the epinotal dorsum is strongly reticulate-rugose. Sixth sternite with an acute curved tooth on each side, the seventh bluntly triangular, the apical without two small teeth. Otherwise like *rothschildi* i. sp. In the original description '*supra* ocellum magnum' is evidently a *lapsus calami*, the triangular swelling on the face being below, and not above, the anterior ocellus.

♀. 12 mm. long. Anterior half of the mesopleura dirty yellow, stained in parts with red. The dorsum of the epinotum with a yellowish-white macula on each side. The pale maculae on the first five tergites cover the greater part of the segments but do not reach the basal and apical margins. Second to fourth sternites ferruginous, blackish at base and apex and with a narrow yellow apical line, interrupted in the middle. Sixth tergite and sternite ferruginous.

Supra-antennal swelling less triangular than in the ♂. Interocular distance on the vertex equal to a little more than the length of the first joint of the flagellum. The second joint is a little more than two and a half times longer than wide and one-fourth longer than the third. First tergite with a short and acute tooth on each side of the vertical anterior face and near its dorsal boundary, the sides of the dorsal face not angular posteriorly as in the ♂. The transverse crest on the second sternite is not broad and flat on its vertical face as in the ♂, but is low and has a trenchant edge which bears seven small teeth. Pygidium long, the sides with large elongate punctures, the dorsal face dull, very finely, closely, and longitudinally striate, at least three times longer than wide at the base.

Ufdem, Ethiopia, 1 ♂, 1 ♀.

Related to *P. O'Neili* Brauns, from which it differs in the ♂ by smaller size, the colour, the shape of the first tergite, and in the ♀ by the colour, the sculpture, and shape of the epinotal declivity.

Palarus obesus sp. n.

(FIG. 49)

♀. 12 mm. long. Mandibles pale yellow at the base, ferruginous at the apex. Clypeus yellowish-white, the rest of the head and the thorax black, the posterior margin at the pronotum excepting the middle, the tegulae, a spot on the mesopleura below the tegulae, the posterior lateral margin of the scutellar area and the metanotum, yellowish-white. First and second abdominal segments pale ferruginous, the third to fifth blackish, the sixth ferruginous, the first to fifth tergites with pale yellow transverse bands, those of third, fourth, and fifth emarginate in the middle of the posterior margin. Fore and middle femora yellowish-white below, the anterior pair black above, the middle pair ferruginous above. Hind femora ferruginous, the extreme apex yellowish, tibiae and tarsi pale ferruginous. Wings hyaline, the veins ochreous. Clypeus, face, and thorax, excepting the epinotum, with silvery pubescence, very sparse on the thorax; temples and epinotum with long white pilosity. Apical margins of the abdominal segments with a few long yellowish hairs.

Clypeus dull, closely and finely punctured, subcarinate lengthwise in the middle, half as wide again as long, the anterior margin convex. Face dull, closely and finely punctured, the space behind the anterior ocelli shining, sparsely punctured, and sharply carinate. Eyes contiguous on the vertex.

Mesothorax and mesonotum nitidulous, sparsely, finely, and very shallowly punctured. Metapleura smooth. Epinotum dull, microscopically reticulate. Abdomen shining, finely and sparsely punctured. Sixth tergite dull, lanceolate, the sides strongly marginate and with a median carinate area which is longitudinally rugose, the space between the median area and the sides obliquely rugoso-punctate; sixth sternite coarsely punctured, and with a strong median carina.

Flagellum moderately clavate, the second joint nearly three times longer than wide and twice as long as the third, the latter a little longer than wide, the fourth and apical as long as wide, the other joints wider than long. Dorsum of the epinotum a little shorter than the scutellum, shallowly depressed in the middle; the declivity vertical, with a median triangular depression, the apex ventrad. Pygidial area nearly twice as long as wide at the base. Anterior tarsi with a well-developed comb, the basal joint with six yellow spines on the outer margin. Second cubital cell with a very short stalk, the second abscissa of the radius two-thirds longer than the first. The first recurrent vein meets the first cubital cell not far from the first transverse cubital vein, the second meets the second transverse cubital vein. Radial cell not appendiculate.

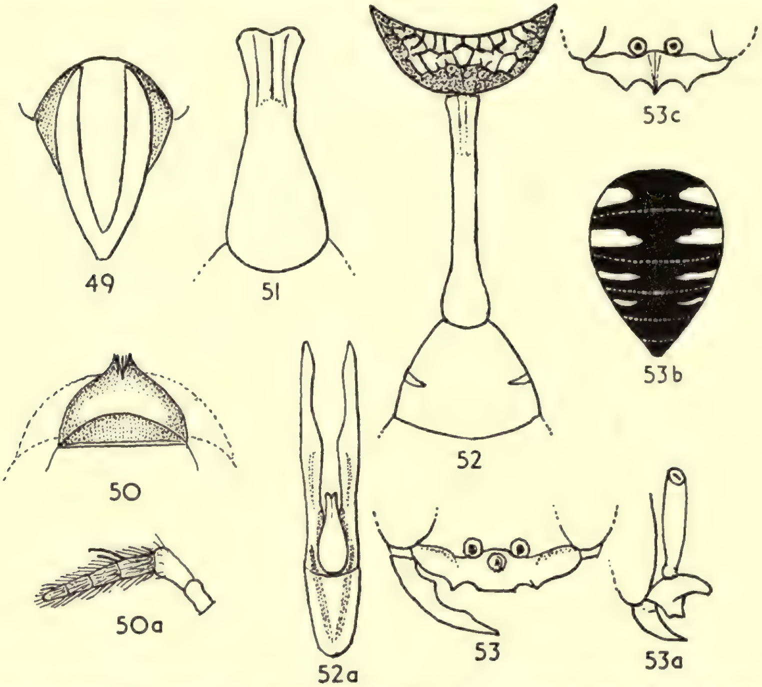


FIG. 49. *Palarus obesus* ♀, pygidium, ×*c.* 12. FIG. 50. *Paranysson oscari* ♂, first sternite, ×*c.* 12. FIG. 50*a*. *Paranysson oscari* ♂, maxillary palp, ×27. FIG. 51. *Dasyproctus basifasciatus* ♀, petiole, ×18. FIG. 52. *Dasyproctus stevensonianus occidentalis* ♂, epinotum and petiole, ×18. FIG. 52*a*. *Dasyproctus stevensonianus occidentalis* ♂, genitalia, ×24. FIGS. 53 and 53*a*. *Oxybelus coniferus* ♀, clypeus, ×15. FIG. 53*b*. *Oxybelus coniferus*, abdomen, ×7½. FIG. 53*c*. *Oxybelus coniferus* ♂, clypeus, ×15.

Podor, S. Mauritania, September 1943, 2 ♀♀.

Apparently more closely related to the Indian *P. comberi* Turner than to any of the African species, differing from it by the shape of the yellow markings on the abdomen, the coarse puncturation of the mesonotum, and the colour of the legs. The shape of the pygidial dorsum appears to be the same, judging by Turner's description.

Paranysson oscari Turner

(FIGS. 50 and 50*a*)

1914, *Ann. Mag. Nat. Hist.* (8) **14:** 341, ♀.

Aburi, Gold Coast, December 1941, 3 ♂♂.

In this species the maxillary and labial palpi are densely pubescent, and the basal sternite is very convex, rising caudad, and is sharply truncate a little in front of the hind margin. In *P. helioryctoides* Turner the basal sternite is similar, but as it does not rise so high caudad, the face of the truncation is shorter.

Subfamily PEMPHREDONINAE

Psenulus pauxillus laevior subsp. n.

P. pauxillus, Arnold, 1947, *Occ. Pap. Nat. Mus. S. Rhod.* **2:** 159.

♂. 6·5 mm. long. Femora brown. Mesonotum one and a half times wider than long, wider than in *pauxillus* i. sp. in which it is only one and two-fifths wider, less strongly and less closely punctured, and without the feeble transverse ridges between the punctures. The dorsum of the epinotum is only feebly rugulose at the sides and the Y-shaped groove is narrower. The interocular distance on the vertex is shorter, being equal to the length of the first three joints of the flagellum plus half of the fourth.

Gambeila, Ethiopia, February 1948, 1 ♂.

Subfamily CRABRONINAE

All the specimens in this collection belong to the species-group *Dasyproctus*. For the validity of genera and subgenera in this subfamily, as opposed to species-groups, I would refer the reader to my remarks on the subject in my *Monograph of the Sphecidae of Madagascar*, 1945, p. 157.

Crabro (Dasyproctus) oedignathus Arnold

1933, *Ann. Mag. Nat. Hist.* (10) **11:** 355, ♂.

Adis Ababa, Wondo, Akaki, Mount Chillala (8,000–9,000 ft.), Ethiopia, 11 ♂♂, 3 ♀♀.

♀. 11 mm. long (hitherto undescribed). Pubescence on the clypeus pale golden, the sixth tergite entirely black. The puncturation on the vertex behind the brow of the face finer, and the sculpture of the epinotum is also finer, the median triangular area is without longitudinal rugae and is only reticulate-rugose. Mandibles of the usual shape, not angularly dilated near the base as in the ♂. Second joint of the flagellum two and two-thirds longer than wide (twice as long as wide in the ♂); the fifth joint not dilated below. Otherwise like the ♂.

Crabro (Dasyproctus) pullatus uniguttatus subsp. n.

C. pullatus Arnold, 1944, *Occ. Pap. Nat. Mus. S. Rhod.* **2**: 30.

♂. 8–8·5 mm. long. Pronotal tubercles straw-yellow. The vertex in front of the anterior ocellus is much more strongly punctured than in *pullatus* i. sp. The punctures are about one-fourth as wide as the anterior ocellus and the interspaces are two and a half times wider than the punctures. The node of the petiole is a little thicker.

Wondo, Ethiopia, April 1948, 4 ♂♂.

Crabro (Dasyproctus) basifasciatus sp. n.

(FIG. 51)

♀. 9·5 mm. long. Black. The following parts lemon-yellow: scapes, pronotal dorsum except in the middle, pronotal tubercles, a small spot on the anterior angles of the scutellum, transverse and narrow bands, interrupted in the middle, at the extreme base of the third and fourth tergites, the upper sides of the fore and middle tibiae, and a spot near the apex of the hind tibiae. Tarsi fusco-ferruginous. Mandibles ferruginous. The sculpture hardly differs from that of *C. dubiosus* Arnold, but under a high magnification (30 diameters) the mesonotum and scutellum have minute punctures with interspaces three to four times wider than the punctures. The posterior corners of the mesonotum and the sides of the scutellum have a few very low longitudinal rugae.

Clypeus like that of *dubiosus*, the median lobe a little more deeply excised. The second joint of the flagellum a little thicker, being two and a third times longer than wide (nearly three times in *dubiosus*). The petiole of the abdomen is much shorter than in *dubiosus* or in any other species of the group excepting *C. ruficaudis* Arnold and *C. barkeri* Arnold; it is two and a half times longer than wide across the node, whereas in *dubiosus* it is nearly three times longer.

Moggio, Ethiopia, April 1948, 1 ♀.

Closely related to *dubiosus*, from which it differs by the shorter and thicker petiole and the ground colour of the legs, and the position of the yellow bands on the tergites.

Crabro (Dasyproctus) stevensonianus occidentalis subsp. n.

(FIGS. 52 and 52*a*)

C. stevensoni Arnold, 1926, *Ann. Transv. Mus.* **2**: 369.
C. stevensonianus Arnold (nom. nov.), 1940, ibid. **20**: 135.

♂. 7 mm. long. This race differs from the type of the species as follows: scapes with a brown macula on the inner side below. Anterior tibiae yellowish-red below, dark brown above, all the tarsi brownish-black, all the rest of the legs black. The yellow maculae on the second tergite duller and smaller. The reticulations on the epinotum are much higher and wider apart.

As in the type of the species ♂, the petiole is five times longer than wide across the node.

Aburi, Gold Coast, December 1944, 1 ♂.

Crabro (Dasyproctus) bipunctatus Lepeletier var. **avius** var. nov.

D. bipunctatus Lepeletier, 1834, *Ann. Soc. Ent. Fr.* **3**: 802.

♂. 7·5–8·5 mm. long. This differs from the type of the species as follows. Tegulae black. Fore and middle tibiae and tarsi fusco-ferruginous, all the rest of the legs black. Wings hyaline, slightly smoky, the veins and pterostigma black. Pronotal collar shorter, shorter than the first joint of the flagellum (distinctly longer in *bipunctatus* i. sp.), the median groove much shallower and narrower.

♀. 8·5 mm. long. The face and middle tibiae ferruginous. Otherwise like the ♂.

Adis Ababa, Zuquala (9,000 ft.), and Aselle, 4 ♂♂, Lake Bishoftu, Ethiopia, 1 ♀.

Subfamily OXYBELINAE

Oxybelus coniferus sp. n.

(FIGS. 53, 53*a–c*)

♀. 6·5–7·8 mm. long. Black. The following parts yellowish-white: a short and transverse streak on each side of the pronotal dorsum, small spots, sometimes absent, on the anterior corners of the scutellum, the metanotum, transverse and more or less lanceolate maculae on each side of the first four tergites. Anterior tibiae dirty white on the upper side. Apical joint of the tarsi pale brown. Wings hyaline, slightly smoky, veins dark ochreous to black. Tegulae fusco-ferruginous. Mandibles sometimes yellowish-red on the basal half. Mandibles, clypeus, lower half of the face and temples with silvery pubescence.

Metanotum and scutellum with erect, brownish-grey pubescence, the pleura, sterna, and femora below with white and thin pubescence. Median area of the clypeus shining, the anterior margin convex and with a blunt tooth on each side, the base with a transversely compressed, and slightly curved conical protuberance, its apex rounded. The space behind the scapes shining and very finely punctured, the rest of the head dull, very closely punctured, the interspaces not wider than the punctures; on the occiput and temples striated between the punctures. Pronotal dorsum very short, almost linear in the middle, the lateral angles acute. Mesonotum and scutellum shining, a little more strongly punctured than the vertex, the interspaces narrower than the punctures and slightly raised longitudinally, or subrugose. Metapleura nitidulous, coarsely reticulate-rugose. Metapleura strongly, sides of epinotum finely and transversely striate. Metanotum shining, longitudinally and not closely costate. The lateral squama black, rostrate and acute at the apex. Epinotal process canaliculate, narrowed towards the apex which is excised, half as long again as wide at the base. Median triangular area of the epinotal dorsum with eight transverse costae which extend over the lateral areas, the interspaces dull, very finely reticulate. Declivity of the epinotum dull and transversely rugose outside the median triangular space.

Abdomen shining, the tergites very sparsely punctured on the yellow areas at the sides, fairly closely over the basal half and at the apical margin. Pygidial area dull, closely punctured, triangular, the apex truncate. Second sternite sparsely and coarsely punctured, excepting the sides which are closely and finely so. Eyes moderately divergent above and below, the interocular distance on the vertex equal to the length of the flagellum, less the apical joint. Posterior ocelli twice as far from each other as from the eyes. Between the posterior ocelli and the eyes there is a low and oblique torus. Comb of the anterior tarsi ochreous, the basal joint with six spines on the outer margin.

♂. 6·2 mm. long. Femora with a dull yellow macula on the upper side at the base. Face and mesonotum with a slight aeneous tint. Pale maculae on the first to fifth tergites, smaller than in the ♀ and of a chrome-yellow colour. Median area of the clypeus with a longitudinal carina, wide at the base, projecting as a tooth on the concave anterior margin. Pygidial area trapezoidal. Otherwise like the ♀.

Adis Ababa, Wondo, Ethiopia, August and September, 1945, 12 ♀♀, 9 ♂♂.

Related to *O. pilosus* Arnold, from which it differs in both sexes by the greater size, in the ♀ by the shape of the clypeus and its basal process, black pronotal tubercles, stronger puncturation of the mesonotum and tergites, entirely black flagellum, and colour of the tarsi. In the ♂, it differs from *pilosus* by the colour of the legs and of the flagellum.

Oxybelus acutissimus Bischoff var. **propinquus** Arnold

1927, *Ann. Transv. Mus.* **12**: 83.

Haramaia, Ethiopia, May, 1948, 3 ♀♀.

Oxybelus pictus Arnold

1927, *Ann. Transv. Mus.* **12**: 115.

Tillembeya, River Niger, French Sudan, September 1944, 1 ♀.

This specimen is a slight variety, differing from the type of the species by the less close puncturation of the mesonotum, by the stronger sculpture of the lateral areas of the epinotal dorsum, and by the presence of narrow pre-apical yellow bands on the third and fourth tergites as well as on the first and second.

Oxybelus curviscutis Arnold

1927, *Ann. Transv. Mus.* **12**: 109.

Accra, Gold Coast, Tillembeya, River Niger, French Sudan, Dakar, Senegal, and Haramaia, Ethiopia, 5 ♀♀, 4 ♂♂.

The ♀ from Tillembeya is a variety with a reddish pygidium.

Oxybelus pallidus Arnold

1927, *Ann. Transv. Mus.* **12**: 101.

Ufdem, Ethiopia, August 1945, 2 ♂♂.

PART II. POMPILIDAE

This interesting collection of Pompilidae made by Mr. K. M. Guichard and now the property of the British Museum (Natural History) comprises 162 specimens of which a considerable proportion is too defective, lacking antennae or tarsi or wings, to permit of identification; but it has, nevertheless, been possible to work out the great bulk of it quite satisfactorily.

Subfamily PEPSINAE

Genus **Hemipepsis** Dahlbom

1843, *Hymen. Eur.* **1**: 123.
Arnold, 1932, *Ann. Transv. Mus.* **14**: 318–319.
Arnold, 1948, *Occ. Pap. Nat. Mus. S. Rhod.* **14**: 233.

The collection contains twelve specimens of which seven are males. These do not agree with any of the species I have seen, and in view of our present knowledge of the genus and also of the absence of the corresponding females, it would be unwise to describe them as new. I have elsewhere (1932) expressed the opinion that the genus is of recent origin on account of the uniformity of the male genitalia. It is therefore difficult to correlate the sexes unless they are taken *in copula*. The copulatory act is probably of very short duration, as in the Sphecidae, for in nearly forty years of collecting in S. Rhodesia I have only once taken a Pompilid species copulating, *Anoplius fuscus montivagus* Arnold. Both sexes may occasionally be seen on trees of which the flowers have short corollas, such as *Rhus* and *Zizyphus*, but as the reproductive phase in both sexes is then past, they pay no attention to one another, so that their proximity is of little use in correlating the sexes.

Hemipepsis aethiops Kohl

1913, *Rev. Zool. Afr.* **3**: 193.

Didessa River, western Ethiopia, 25 May 1946, 1 ♀. The type was taken at Mpika, N. Rhodesia, not Belgian Congo as stated in Kohl's work.

Hemipepsis fallax Saussure

1892, in Distant: *Nat. Transvaal*: 221.

Didessa River and Lekempti, Ethiopia, May 1946, 2 ♂♂.

Hemipepsis iodoptera meridionalis Arnold

Arnold, 1932, *Ann. Transv. Mus.* **14**: 361.

Kpeve, Gold Coast, June 1942, 1 ♂.

A variety of this race in which the colour of the head and pronotum is castaneous red.

Hemipepsis glabrata anchietae Radoszkovsky

Radoszkovsky, 1881, *J. Sci. Mat. Phys. Nat. Lisboa*, **8**: 213.

Meisso, Ethiopia, 4 September 1945, 1 ♂.

Cyphononyx flavicornis Fabricius var. **antennatus** Smith

1781, *Spec. Insect*, **1**: 450.
Smith, 1855, *Cat. Hymen. B.M.* **3**: 186.

Lake Bishoftu, 7,000 ft., May 1946, 2 ♀♀; Asba Tafari, Ethiopia, 7,800 ft., September 1945, 1 ♂.

Cyphononyx optimus Smith

1855, *Cat. Hymen. B.M.* **3:** 141.

Ghedo, 7,000 ft., May 1946, 1 ♂; Goré, Ethiopia, 6,000 ft., February 1948, 1 ♂.

Cryptocheilus impressiceps Arnold

1932, *Ann. Transv. Mus.* **14:** 376.

Gorgora, Lake Tana, 11 December 1945, 1 ♀.

A slight variety in which the red parts of the head and thorax are much darker than in the type of the species. It should be noted that in this species the width of the vertex is slightly variable. In the type it is equal to the length of the second joint of the flagellum which is five times longer than wide at the apex; in the paratopotype (in the Nat. Mus., S. Rhod.) the interocular distance is fully one-fourth greater than the length of the second joint, and in specimens from Matetsi, S. Rhodesia (in the Nat. Mus., S. Rhod.), it is nearly one-sixth greater, or equal to the length of the first two joints of the flagellum.

Cryptocheilus rhodesianus senegalensis subsp. n.

C. rhodesianus Arnold, 1932, *Ann. Transv. Mus.* **14:** 372.

♀. 12·5 mm. long. This form differs from the type of the species as follows: wings less deeply clouded, the fuscous cloud on the basal vein absent, the distal cloud covers only the lower two-thirds of the second cubital cell and the middle of the upper half of the second discoidal cell. The flagellum is thinner, the second joint being nearly five times longer than wide at the apex. The mandibles and clypeus are entirely black. Interocular distance on the vertex equal to the length of the second joint of the flagellum plus half of the first. Each of the scales on the hind tibiae overhang only one spine, not two as in the type.

Diafarabé, French Sudan, 14 August 1944, type; Tillembeya, River Niger, French Sudan, August 1944, 1 ♀.

Priocnemis modestus sp. n.

(FIG. 54)

♀. 9·5 mm. long. Black. Scapes, second joint of the flagellum, and base of the third joint ferruginous. Legs, excepting the coxae and trochanters, pale ferruginous. Wings smoky, with a fuscous cloud over the apex of the medial cell, and another fuscous cloud covering the radial, second, and third cubital cells, excepting their upper margin, and the outer upper half of the second discoidal cell. Last two joints of the tarsi brown. Mandibles with a few long yellowish hairs. Basal half of the sixth tergite with a dense brown pilosity. Apical margin of the clypeus slightly reddish, not quite dull, and with a transverse row of large punctures. The rest of the clypeus, the face, vertex, promesonotum, and mesopleura dull, reticulate-punctate, the face and scutellum more strongly punctured (30 diameters) than the other parts. Upper half of the metapleura strongly and obliquely striate, the lower half very finely and closely striato-punctate. Epinotum dull, closely transversely rugulose, the rugae stronger and farther apart on the declivity, which is also somewhat reticulate. Abdomen shining, with a microscopic brown pubescence. Clypeus two and two-thirds wider than long, the apical margin feebly concave. Inner orbits slightly divergent below. Interocular distance on the vertex equal to the length of the second joint of the flagellum. Posterior ocelli two and a half times farther from the eyes than from each other. Second joint of the flagellum nearly five and a half times longer than wide at the apex and fully one-third longer than the third joint. Temples nearly as wide as the eyes. Postnotum with a median groove, as long as the metanotum. The junction of the epinotal dorsum with the declivity not clearly delimited, the two forming in profile a low and unbroken arc, the whole segment one-seventh longer than wide. First tergite a little longer than wide at the hind margin, four and a half times wider there than at the base. Second abscissa of the radius four times longer than the first and one-third longer than the third. The first recurrent vein meets the cubitus a little before the middle of the second cubital cell, the second meets the third cubital cell at the end of its proximal third. Nervulus distinctly postfurcal. Cubitus of the hindwing emitted a little beyond the end of the submedial cell. Hind tibiae with a row of nine scales each overlapping a spine, and with a row of spines on each side of the row of scales. Claws with an acute tooth in the middle.

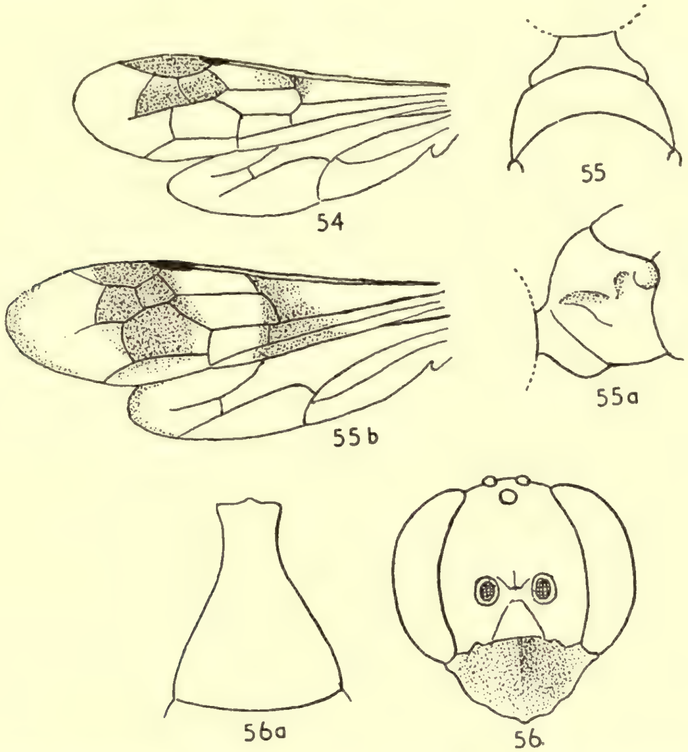


FIG. 54. *Priocnemis modestus* ♀, wings, × *c.* 7. FIGS. 55 and 55*a*. *Marimba guichardi* ♀, pronotum, dorsal and lateral view, × 12. FIG. 55*b*. *Marimba guichardi* ♀, wings, × 7. FIG. 56. *Pseudagenia accraensis* ♀, head, × 12. FIG. 56*a*. *Pseudagenia accraensis* ♀, first tergite, × 12.

Dilla, Ethiopia, April 1948, 1 ♀.

Not closely related to any other Ethiopian species. The colour resembles that of *P. inermis* Arnold, which is a larger species and with much stronger sculpture.

Subfamily CTENOCERATINAE

Genus **Marimba** Pate

Pate, 1946, *Trans. Amer. Ent. Soc.* **72:** 93 and 120.
Turner (*Cryptosalius*), 1918, *Ann. Mag. Nat. Hist.* (9) **1:** 354–355.
Arnold (*Parapompilus*), 1932, *Ann. Transv. Mus.* **15:** 89, 104–106.

Marimba guichardi sp. n.

(FIGS. 55, 55*a* and 55*b*)

♀. 11·5 mm. long. Black, head and prothorax very dark reddish-brown. First six joints of the antennae, legs, and extreme apex of sixth tergite, fusco-ferruginous. Wings hyaline, bifasciated, the inner fascia covering the apical two-fifths of the medial, first submedial and anal cells and the base of the second submedial and first discoidal cells, the outer fascia covering the radial cell excepting the apex, the second and third cubital, the apex of the first cubital cell and first discoidal cell, and the second discoidal cell excepting the base. Flagellum, mesosternum, and coxae covered with a decumbent, very fine and silvery pubescence. Lower corners of the epinotum with exserted silvery pubescence, the apical margins of the first three tergites with decumbent silvery pubescence at the sides. Labrum semicircular, the galea extending beyond the closed mandibles, the latter with a tooth behind the apex. Clypeus microscopically and closely punctured, with a greasy lustre, nearly three times wider than long, the anterior margin straight. Face finely and very closely punctured (25 diameters), the interspaces as wide as the punctures. Inner orbits parallel. On each side of the bottom of the face there is a deep circular pit, half on the face and half on the clypeus. Inter-antennal tubercle prominent; a narrow impressed line extends from it to the anterior ocellus. Posterior ocelli very little farther from each other than from the eyes. Interocular distance on the vertex equal to the length of the second joint of the flagellum plus two-ninths of the third joint; the second joint is slightly more than three times longer than wide at the apex and the third joint is one-sixth longer than the second. The puncturation of the dull promesonotum and scutellum is like that of the face but a little larger. The dorsum of the pronotum merges gradually into the anterior face, the sides are nitidulous, with a few large punctures, and the transverse groove is wide. Mesonotum three times longer than the pronotum. Scutellum very convex, subcarinate lengthwise in the middle.

Postnotum much shorter than the metanotum and depressed. Mesopleura coarsely rugose, pitted between the rugae. Metapleura obliquely costate. Dorsum of the epinotum two-thirds wider than long, shining, very coarsely and transversely rugose, with numerous anastomoses or almost reticulate-rugose, the interspaces wide, about as wide as the ocelli, the sides more closely rugose, the declivity oblique, shining, and with seven transverse rugae. Abdomen lanceolate, two and two-thirds longer than wide across the middle, the first tergite as long as wide behind and four times wider there than at the base. Sixth tergite longer than wide at the base, the apex subacute. Transverse groove of the second sternite between the first and second third of the segment. Second abscissa of the radius a trifle longer than the third and four times longer than the first. Cubitus of the hindwing emitted a little before the end of the submedial cell. Claws bifid.

Dilla, Ethiopia, April 1948, 1 ♀.

Apparently closely related to *M. indocilis* Turner, which I have not seen, but differing therefrom according to Turner's description as follows: the smaller size, the colour of the legs and basal joints of the antennae, the shorter second abscissa of the radius, and the close puncturation of the promesonotum. From *M. contristans* Turner it differs also by the puncturation of the pro- and mesothorax, the smaller size, and the colour of the wings. These two species and two others from Africa were described by Turner (1918) and placed in his genus *Cryptosalius* (genotype *C. rava* Bingham). In my monograph of the Ethiopian Pompilidae I placed *Cryptosalius* in synonymy with *Parapompilus*. However, Pate (1946) indicated that Turner's African species were not congeneric with *C. rava* and proposed for them the new generic name *Marimba*. These species and the one described above differ from *Parapompilus* in the absence of a tarsal comb, the fasciated wings, and the long and very coarsely sculptured epinotum. Another distinction mentioned by Pate, 'the humeral angles of the pronotum not broadly rounded as in *Parapompilus*', does not hold good, as in this species, *guichardi*, they are rounded. Until the males are known, the relationship of *Marimba* with *Parapompilus* cannot be decided.

Subfamily PSEUDAGENIINAE

Pseudagenia pseudocyphononyx Turner

1918, *Ann. Mag. Nat. Hist.* (9) **1**: 352.

Adis Ababa, 3 August 1945; Zuquala, Ethiopia, October 1945, 2 ♀♀.

Somewhat smaller and with shorter wings than in the type and specimens from S. Rhodesia.

Pseudagenia accraensis sp. n.

(FIGS. 56, 56*a*)

♀. 16 mm. long. Mesopleura, metanotum, metapleura, epinotum, and the first three abdominal segments black, the rest of the body, the antennae, and legs pale ferruginous. Wings very pale yellowish-brown, slightly darker over the radial, second cubital, and the upper half of the second discoidal cells, but not fasciated. Face and clypeus with a microscopic reddish pubescence. Mesopleura closely and very finely reticulate rugose, metapleura closely striate, epinotum closely, transversely, and finely rugose, the rugae strongest on the posterior half of the epinotal dorsum. Clypeus very convex transversely, nearly half as wide again as long in the middle, the anterior margin convex, with a slight projection in the middle. Interocular distance across the base of the clypeus one-third greater than across the vertex, where it is equal to three-fourths of the length of the second joint of the flagellum. Posterior ocelli as far from the eyes as from each other. Flagellum long and slender, all the joints excepting the first at least six times longer than wide, the second joint nearly seven times longer than wide at the apex and one-seventh longer than the third.

Scutellum fairly flat, two-thirds as long as wide at the base. Postnotum shining, finely and transversely striate, as long as the metanotum. The whole epinotum is as long as wide at the base, the dorsum merges gradually into the declivity, the whole forming a low curve in profile. First tergite one-fifth longer than wide, very narrow basad. Second abscissa of the radius three times longer than the first, and half as long again as the second. The wings extend back to the apex of the abdomen.

Accra, 1941, 1 ♀.

The species nearest to this one is *P. lujae* Arnold, from which it differs by the longer clypeus, the narrower vertex, the much more slender antennae, the longer peduncle of the first tergite, and the colour of the wings.

Pseudagenia stigmalis R. Lucas

1898, *Deutsch Ost-Afr.* (3) **4:** 61.
Arnold, 1934, *Ann. Transv. Mus.* **15:** 342, 346.

Adis Ababa, 3 August 1945, 2 ♀♀.

It is with some hesitation that I ascribe these two specimens to this species, since the original description is quite inadequate. They appear to differ only in having the hind femora entirely ferruginous, and the face also of that colour excepting a black streak adjacent to the antennal sockets.

Pseudagenia laevigata Smith

1855, *Cat. Hymen. B.M.* **3:** 143.

Accra, Gold Coast, June 1941, 2 ♀♀.

Pseudagenia flavotegulata Bingham

1902, *Ann. Mag. Nat. Hist.* (7) **9:** 208.

Kaolack, Senegal, August 1943, 1 ♀.

A slight variety in which the base of the hind coxae on the upper side, the first abdominal segment and the sides and pre-apical bands on the second and third tergites, and the middle of the second and third sternites are black.

Pseudagenia infantula Kohl

1894, *Ann. naturh. Hofmus. Wien,* **9**: 307.

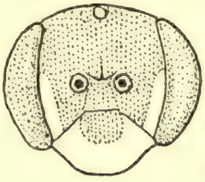
Lake Bishoftu, Ethiopia, July 1945, 1 ♀.

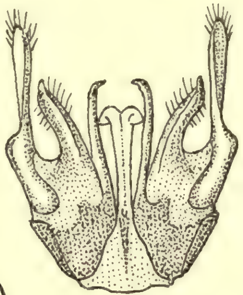
This specimen represents a slight variety in which the vertex is a little narrower, being equal to the length of the second joint of the flagellum, and the first tergite as long as wide behind. The distinctive shape of the clypeus is exactly like that of *infantula* i. sp.

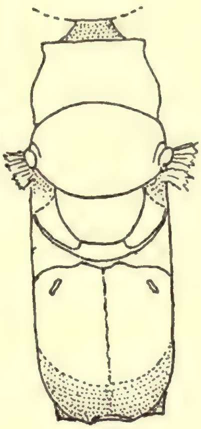
Pseudagenia albosignata sp. n.

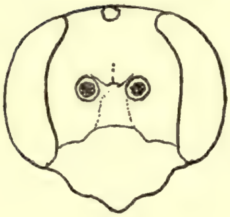
(FIGS. 57, 57*a* and 57*b*)

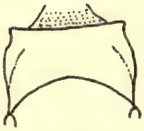
♂. 8 mm. long. Black. Clypeus, excepting the basal half of the middle, and the sides of the face to a little beyond the level of the antennal sockets, dirty white. Legs ferruginous, the coxae, trochanters, and tarsi brown. Wings hyaline, with a pale fuscous cloud over the basal vein and nervulus, and an outer fuscous cloud covering the basal third of the radial cell, the greater part of the second cubital cell and a small area on the upper part of the second discoidal cell; the apex of the forewing also slightly fuscous. Clypeus and face with a sparse brownish pilosity, the temples, coxae, posterior half of the mesosternum and posterior angles of the epinotum with a decumbent silvery pubescence, the latter and the mesosternum and metapleura also with some longer, exserted, and white hairs. Postnotum shining, arcuately and transversely striate, depressed in the middle and as long as the metanotum. The rest of the thorax and the head dull, very finely reticulate-punctate (30 diameters), the epinotum also transversely rugulose, feebly so over the basal third. Tergites with a microscopic greyish pubescence.

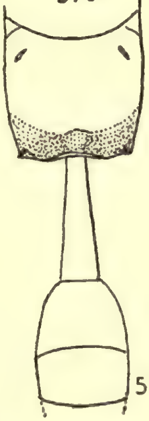

57a


57b


58


57


59


59a

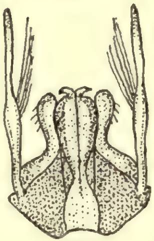

60

FIG. 57. *Pseudagenia albosignata* ♀, head, ×15. FIG. 57*a*. *Pseudagenia albosignata* ♂, head, ×15. FIG. 57*b*. *Pseudagenia albosignata* ♂, genitalia, ×*c*. 45. FIG. 58. *Poecilagenia longicollis* ♀, thorax, ×15. FIG. 59. *Poecilagenia rugosa* ♂, pronotum, ×12. FIG. 59*a*. *Poecilagenia rugosa* ♂, epinotum and basal tergites, ×12. FIG. 60. *Paracyphononyx funebris* ♂, genitalia, ×30.

Clypeus very convex, nearly half as wide again as long, the anterior margin convex. Inner orbits slightly convergent below, the interocular distance on the vertex equal to a trifle more than the length of the first two joints of the flagellum. Posterior ocelli twice as far from the eyes as from each other. Second joint of the flagellum five and a half times longer than wide and barely longer than the third.

Dorsum of the pronotum half as long as the mesonotum, the anterior face sub-vertical, the shoulders rounded. Scutellum very convex. Dorsum and declivity of the epinotum not distinctly delimited, the two parts forming a low arc in profile; the dorsal face with a shallow median longitudinal groove, the whole segment as long as wide. First tergite nearly twice as long as wide behind, and a little more than twice as wide there as at the base, the sides straight. Second abscissa of the radius two-thirds longer than the first, the third two-fifths longer than the second; the nervulus almost interstitial with the basal vein.

♀. 9 mm. long. Face and clypeus entirely black; antennae fusco-ferruginous. Sixth tergite broadly triangular, flat, shining, and sparsely punctured. Otherwise like the ♂ in colour, sculpture, and pubescence. Clypeus two-fifths wider than long, the anterior margin produced into a blunt triangular lobe. Face as wide below as on the vertex, where the interocular distance is equal to a very little less than the length of the first two joints of the flagellum. Posterior ocelli not quite twice as far from the eyes as from each other. Flagellum slender, the second joint five times longer than wide at the apex. First tergite wider caudad than in the ♂, only three-sevenths longer than wide behind. Otherwise like the ♂.

Adis Ababa, August–September 1945, 2 ♂♂, 1 ♀; Lekempti, Ethiopia, May 1946, 1 ♂.

Related to *P. rubrirostris* Arnold, from which it differs by the colour of the legs, the paler fasciae of the wings, and the more acute lobe of the clypeus. It also resembles *P. amita* Arnold, but is smaller, differently coloured, and with a less prominent lobe on the clypeus.

Poecilagenia longicollis sp. n.

(Fig. 58)

♀. 8·5 mm. long. Head, pro-mesonotum, scutellum, metanotum, anterior half of the meso- and metapleura, and anterior legs, pale ferruginous. Posterior half of the mesopleura, the metapleura, epinotum, and abdomen, black. Middle and hind tibiae fusco-ferruginous. Antennae pale ferruginous at the base, becoming gradually darker to fuscous from the fifth joint onwards. Wings hyaline, with a pale fuscous cloud covering the basal third of the radial cell, distal half of the second cubital, proximal half of the third cubital cell, and the distal upper corner of the second discoidal cell. Mesopleura and posterior corner of the epinotum with decumbent silvery pubescence, the tergites with sparse, very fine and grey pubescence. Clypeus slightly shining, very shallowly punctured. Face dull, closely and finely reticulate-punctate, the vertex nitidulous and with a few punctures. Pronotum not quite dull, closely and transversely striate. Mesonotum transversely, the scutellum longitudinally and closely rugulose and nearly dull. Mesopleura obliquely, metapleura transversely rugose. Epinotum dull, coarsely reticulate-rugose, and with a fine median longitudinal carina. Abdomen shining and impunctate. Mandibles with a small tooth just behind the apex. Maxillary palpi long, the last three joints united fully as long as the first three joints of the flagellum. Clypeus nearly two and a third times wider than long, the apical margin convex. The interocular distance on the vertex is very little less than it is across the bottom of the eyes and is equal to the length of the first two joints of the flagellum. Posterior ocelli a little farther from the eyes than from each other. First joint of the flagellum half as long again as wide, the second joint three and three-fifths longer than wide at the apex, four-fifths longer than the third which is twice as long as wide. Dorsum of the pronotum widest across the middle, twice as wide there as long, the anterior margin straight, the shoulders subrectangular. Mesonotum three-eighths longer than the pronotum. Scutellum and disk of the metanotum feebly convex. Postnotum shallow, in the middle one-third as long as the metanotum. Dorsum of the epinotum parallel-sided, about one-ninth wider at the base than long, the declivity about half as long as the dorsum and oblique. First tergite about one-fourth longer than wide at the posterior margin, and one-third longer than the second tergite.

Second abscissa of the radius twice as long as the first, a little longer than the third which is half as long as the fourth. Transverse anal vein of the hindwing prefurcal.

Aburi, Gold Coast, December 1941, 1 ♀.

Differs from *P. reversa* Bischoff by the longer pronotum and epinotum, narrower vertex, and paler red colour.

Poecilagenia rugosa sp. n.
(FIGS. 59, 59*a*)

♂. 8 mm. long. Head, pro- and meso-sternum, the middle third lengthwise of the epinotum, abdomen, coxae, trochanters, and the hind legs black. The thorax above and at the sides dark red. Apex of the mandibles ferruginous, the acute inferior edge of the scapes yellowish, the apical tergite pale yellow. Fore and middle legs, excepting the coxae and trochanters, fusco-ferruginous. Wings hyaline, with a pale brown cloud covering the greater part of the radial, second, and third cubital cells and the distal corner of the second discoidal cell. Clypeus and face with a short, coarse, and yellowish pubescence, the temples with long greyish pilosity. Dorsum of the thorax excepting the base of the epinotum and the pronotum nearly glabrous, the rest of the thorax and the coxae and trochanters with a coarse silvery pubescence intermixed with a long pilosity of the same colour, sufficiently dense to obscure the sculpture on the pronotum and epinotum. Abdomen with a decumbent, very fine and grey pubescence. Clypeus and face dull, strongly and closely punctured, the temples, vertex, and occiput more sparsely so and not quite dull. Pronotum and mesopleura coarsely reticulate-rugose. Mesonotum dull, reticulate-punctate, the rugae thicker transversely, the scutellum and metanotum with a similar but larger sculpture. Postnotum half as long as the metanotal disk, with two or three costae on each side of the median depression. Metapleura obliquely costate. Epinotum very coarsely reticulate-rugose, the majority of the interspaces fully as wide as the ocelli. Hind coxae coarsely rugoso-punctate and swollen at the base on the upper side.

Clypeus a little more than twice as wide as long, the anterior margin feebly convex. Antennal sockets twice as far from each other as from the eyes, in consequence of which the supra-antennal tubercle is wide. Interocular distance on the vertex equal to the length of the first four joints of the flagellum and one-fifth greater than across the base of the clypeus. Ocellar area tumid, the posterior ocelli as far from the eyes as from each other. Temples narrow. Scapes transversely compressed, with a sharp edge on the underside. First joint of the flagellum a little longer than wide, the second not quite twice as long as wide and as long as the third. Dorsum of the pronotum fairly convex transversely, two and a half times wider in the middle than long, the anterior margin nearly straight, the anterior face vertical, the shoulders subrectangular. Mesonotum twice as long as the pronotum. Scutellum convex transversely, as long as wide at the base. The dorsum and the very oblique declivity of the epinotum form a very low arc in profile; the whole segment is one-seventh wider at the base than long, and the sides are feebly convex. Abdomen clavate, the first tergite long and narrow, transversely compressed, the sides vertical and flat, three times longer than wide at the apical margin which is less than twice as wide as the base. The rest of the abdominal complex is narrow and five-sixths longer than the first tergite. The length of the first three abscissae of the radius are as 5:12:10. Cubitus of the hindwing interstitial with the transverse anal vein.

Diafarabé, French Sudan, 5 August 1944, 1 ♂.

This specimen is badly damaged, the head and pro-mesonotum being separated from the thorax, and parts of the legs are missing. However, objectionable as it is to base a new species on such specimens, I have done so in this case, as the species is so distinct from the other known males of the genus that it can be recognized without difficulty.

Cyemagenia rubrozonata Cameron

1910, *Sjöstedt's Kilimandjaro-Meru Exped.* **8:** 253.

Dilla and Haramaia, Ethiopia, April 1948, 1 ♀, 4 ♂♂.

Subfamily Pompilinae

Atopopompilus venans mlanjiensis Arnold

1937, *Ann. Transv. Mus.* **19:** 24.

Accra, Gold Coast, 13 July 1941, 1 ♀.

This specimen is an aberration in which the second and third abscissae of the radius are of about equal length. Otherwise it agrees in all respects with the type of the subspecies.

Paracyphononyx affinis Haupt

1929, *Mitt. Zool. Mus. Berl.* **15:** 170.

Aburi, Gold Coast, December 1941, 1 ♂.

Paracyphononyx difficilis Bischoff

1913, *Arch. Naturgesch.* **79:** 55.

Tillembeya, River Niger, French Sudan, 14 August 1944, 1 ♂; Accra, May 1941, 1 ♂.

Paracyphononyx laboriosus Arnold

1936, *Ann. Transv. Mus.* **18:** 438.

Asba Tafari, Ethiopia, 7,800 ft., September 1945, 1 ♀.

Paracyphononyx metemmensis Magretti

1884, *Ann. Mus. Stor. Nat. Genova,* **21:** 565.

Tillembeya, River Niger, French Sudan, August 1944, 1 ♂; Accra, Gold Coast, December 1941, 1 ♂.

Paracyphononyx funebris sp. n.

(FIG. 60)

♂. 7·5–9·5 mm. long. Black. Flagellum ferruginous below, brownish-black above, scape dirty yellow on the underside. Wings fuscous. Clypeus, face, and underside of the coxae with greyish-silvery pubescence, the head and pronotal collar also with black, erect hairs. Epinotal declivity and base of the first tergite with a dense, coarse, erect whitish pubescence, the extreme base of the second, third, and fourth tergites with a decumbent bluish-grey bloom. Sixth tergite white.

Clypeus nearly two and a half times wider than long, separated from the bottom of the eyes by a length equal to two-thirds of the cheeks. Interocular distance on the vertex very slightly less than the interocular distance across the base of the clypeus, and equal to the length of the first two joints of the flagellum plus two-thirds of the third joint. The fourth to eleventh joints of the flagellum are dilated below near the base, and the second joint is a little shorter than the third. Posterior ocelli two-thirds farther from each other than from the eyes. Pronotum two and a half times wider across the posterior angles than long. Dorsum of the epinotum twice as wide at the base as long, twice as long as the declivity, the junction of the two faces rounded. First tergite as long as wide behind. First abscissa of the radius a little longer than the second; third cubital cell petiolate, the petiole variable in length, but sometimes as long as the second abscissa of the radius.

Haramaia, Ethiopia, May 1948, on *Myosotis* flowers, 19 ♂♂.

Related to *difficilis* Bischoff, from which it differs by the colour of the legs, the darker wings, wider clypeus, and the genitalia. In the latter the outer paramera are not spatulate as in *difficilis*, but narrow and strap-like, with six long hairs emitted from about the middle of the inner margin.

Paracyphononyx zonatus Illiger

1802, *Mag. Insektenkunde*, **1**: 193.

Diafarabé, French Sudan, 14 August 1944, 1 ♂.

A slight variety with the outer paramera of the genitalia narrower in the middle.

In addition to the species listed above, the collection contains seven females, representing two or three species of the genus *Paracyphononyx*, which do not agree with any of the species known to me. It would be unwise to describe these as new in the absence of specimens which could be indubitably considered the opposite sex. In this genus the males can easily be determined by the genitalia, but the females are far more difficult to determine.

Episyron histrio Lepeletier

1845, *Hist. Nat. Ins. Hymén.* **3**: 440.

Tillembeya, River Niger, French Sudan, 14 August 1944, 1 ♀; Abbai Gorge and River Didessa, Ethiopia, 23 October 1945, 25 August 1946, 1 ♀, 1 ♂.

The specimen from the Didessa, 11 mm. long, is not only larger than the typical ♂ of the species but differs considerably in colour, the first four abdominal segments being black, excepting the yellow bands on the second and third tergites. The genitalia, however, are identical.

Batazonellus capensis Dahlbom

1843, *Hymen. Eur.* **1**: 49.
Batazonellus Arnold, 1937, *Ann. Transv. Mus.* **19**: 1.

Lake Bishoftu, Ethiopia, 12 May 1946, 1 ♀.

Schistonyx umbrosus Klug

1834, *Symb. phys.*, Dec. 4, T. 39, F. 4.

Dakar, Senegal, 1 August 1945, 2 ♀♀.

Elaphrosyron insidiosus Smith

1879, *Descr. new sp. Hymen.*: 143.

Kaolack, Senegal, 1 ♀; Diafarabé, French Sudan, 1 ♀; Dilla, Ethiopia, 2 ♂♂.

GUICHARDIA gen. n.

Characters

♂. Palpi short, the last three joints of the maxillary palpi not more than three times longer than wide. Labrum exposed. Mandibles with a tooth behind the apex. Clypeus feebly convex, as wide as the bottom of the face. Cheeks very short. Face without a supra-antennal tubercle. Occiput not concave, its junction with the vertex rounded. Pronotum not much shorter than the mesonotum, convex lengthwise. Lateral margins of the mesonotum feebly reflexed posteriorly. Sides of the scutellum steep, raised above the level of the metanotum. Postnotum linear. Dorsum of the epinotum convex lengthwise and transversely, forming in profile a low and unbroken arc with the very short declivity, its posterior angles dentiform. Apical ventral valve produced into a long spine. Femora of the trachyscelid type. Claws bifid, the pulvillus small and with about ten short cilia. Wings with three cubital cells, the third much wider on the cubitus than on the radius; nervulus slightly prefurcal. Cubitus of the hindwing emitted a little beyond the end of the submedial cell, the basal lobe small.

Genotype: *G. macilenta* Arnold.

The subdentate posterior angles of the epinotal dorsum are very similar to those of *Epiclinotus* Haupt, but the wide clypeus and the rounded junction of the slightly convex occiput with the vertex show that the genus belongs to the tribe Pompilini.

Guichardia macilenta sp. n.

(Figs. 61, 61*a*–*d*)

♂. 10·5–11 mm. long. Black. Head and thorax with a fine, decumbent grey pubescence and without erect pilosity. First three abdominal segments (or four in the paratype) with a dense, long, greyish-silvery pubescence, the remaining segments with a thin black pubescence and some longer and erect black hairs. Wings almost hyaline over the basal fourth, the rest moderately fuscous with traces of darker clouds over the basal vein area and the radial and second cubital cells. Clypeus two-thirds wider than long, the lateral margins long, the anterior margin straight. Inner orbits parallel below, slightly divergent above the middle and convergent on the vertex, the interocular distance there no greater than across the base of the clypeus, and equal to the length of the second and third joints of the flagellum united. Posterior ocelli slightly nearer to the eyes than to each other. Second joint of the flagellum as long as the third, and nearly two and a half times longer than wide.

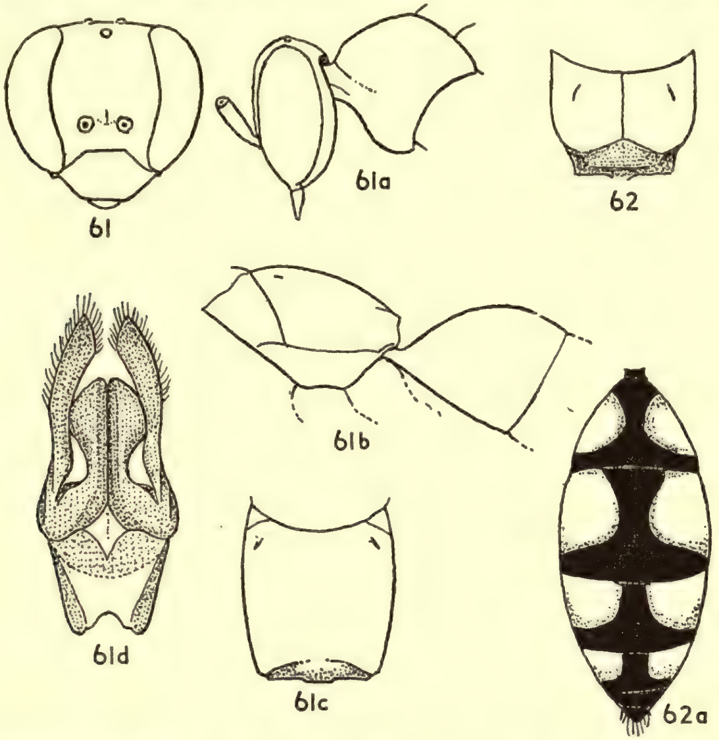


FIG. 61. *Guichardia macilenta* ♂, head, × 12. FIG. 61*a*. *Guichardia macilenta*, head and pronotum, × 12. FIG. 61*b*. *Guichardia macilenta*, epinotum and first tergite, × 12. FIG. 61*c*. *Guichardia macilenta*, epinotum, × 12. FIG. 61*d*. *Guichardia macilenta*, genitalia, × 27. FIG. 62. *Anoplius octomaculatus* ♀, epinotum, × 6. FIG. 62*a*. *Anoplius octomaculatus*, abdomen, × 6.

Pronotum convex lengthwise, seven-ninths wider across the posterior angles than long in the middle, moderately narrowed cephalad, the hind margin obtusely angular. The horizontal part of the scutellum one-fifth longer than wide, and about three times longer than the metanotal disk. Epinotum moderately convex lengthwise and transversely, about one-eighth longer than wide at the base, the lateral margins convex; the dorsum is about four times longer than the very oblique declivity, its posterior angles subdentiform. Abdomen narrow, the first tergite about one-seventh longer than wide at the apical margin. First and third abscissae of the radius of equal length, and half as long as the second. The third cubital cell three and two-thirds wider on the cubitus than on the radius; both recurrent veins meet the second and third cubital cells a little beyond the middle.

Agogo, Gold Coast (type), 30 January 1942; Aburi, Gold Coast, 21 January 1941.

Anoplius octomaculatus sp. n.

(FIGS. 62 and 62*a*)

♀. 15 mm. long. Black. First four tergites with large yellowish-red maculae on each side. Wings dark fuscous. Clypeus with a sparse grey pubescence, the face with a small patch of silvery pubescence on each side, adjacent to the eyes and at about the level of the antennal sockets, the rest of the face and the temples with a very sparse black pilosity. The posterior corners of the mesopleura, the inner half of the upperside of the middle and hind coxae with dense and brilliant silvery pubescence. The setae on the apical abdominal segment long and black. Clypeus two and a quarter times wider than long, the apical margin feebly convex. The inferior interocular distance a little greater than across the vertex, where it is equal to slightly less than the length of the second joint of the flagellum. Posterior ocelli one-third farther from the eyes than from each other. Antennae slender, the second joint of the flagellum six times longer than wide at the apex and one-third longer than the third joint. Temples half as wide as the eyes. Pronotum three and a half times wider between the posterior angles than long in the middle. Scutellum three-fourths as long as the mesonotum. Disk of the metanotum flat, truncate behind. Postnotum depressed, half as long as the metanotal disk, shining and transversely striate. Dorsum of the epinotum more than twice as wide at the base as long, with a median longitudinal impressed line, the declivity steep, compressed at the sides and not much shorter than the dorsum. Second abscissa of the radius five-eighths longer than the first, the third cubital cell petiolate, the petiole very short, or about one-fifth the length of the first abscissa of the radius. Both recurrent veins meet the cubital cells beyond their middle. Transverse anal vein of the hindwing postfurcal.

Tillembeya, River Niger, French Sudan, 26 September 1944, 1 ♀.

Not closely related to any other Ethiopian species, and easily recognized by the silvery pubescence on the mesopleura and coxae and the large red maculae on the tergites.

Anoplius successor Cameron

1910, *Sjöstedt's Kilimandjaro-Meru Exped.* **8**: 251.
A. subfasciatus Arnold, 1937, *Ann. Transv. Mus.* **19**: 63.

River Didessa, May 1946, and Debra Sina, Ethiopia, September 1945, 2 ♀♀. The specimen from Debra Sina is a slight variety in which the wings are darker and the pubescence entirely black.

Anoplius morosus Smith

1855, *Cat. Hymen. B.M.* **3**: 140.

Akaki and Asba Tafari, Ethiopia, February 1948, 1 ♀, 2 ♂♂.

Anoplius fuscus L.

1761, *Fauna Suec.* ed. 2: 412.
Arnold, 1937, *Ann. Transv. Mus.* **19**: 65.

In my monograph of the Ethiopian Pompilidae I remarked on the variability of this species in the Ethiopian region and named some varieties. There are four specimens in the collection, from different parts of Ethiopia, of which one agrees with the var. *acutiangulus* Cameron, and the others differ only in a minor degree from the varieties *montivagus*, *johannis*, and *brachcerus* Arnold. It would serve no useful purpose to give names to these specimens since the variations grade one into another.

Pompilus plumbeus Fabricius

1787, *Mant. Ins.* **1**: 278.

Labadi, Gold Coast; Fatick, Senegal; Tillembeya, River Niger, French Sudan, and River Hawash, Ethiopia, 1 ♂, 4 ♀♀.

The specimens from Fatick and Hawash represent a slight variety in which the first four joints of the anterior tarsi and the second to fourth of the middle and hind tarsi are yellowish-red.

Pompilus rutilus Klug subsp. **lutarius** Saussure

1834, *Symb. phys.* **4**: T. 38.
Saussure, 1891, *Mitt. Schweiz. Ent. Ges.* **81**: 265.

Accra and Labadi, Gold Coast; Tillembeya, River Niger, French Sudan; Diafarabé, French Sudan, 3 ♀♀, 8 ♂♂.

Pompilus cinnamomeus Arnold

1937, *Ann. Transv. Mus.* **19**: 52.

Accra, Gold Coast, September 1941, 6 ♀♀.

Pompilus contrarius sp. n.

(FIG. 63)

♀. 8·5 mm. long. Head and thorax black, the anterior half of the clypeus and the neck and lateral margins of the pronotum, flavo-ferruginous. Mandibles ferruginous, the apex black. Abdomen and legs pale ferruginous, antennae fusco-ferruginous. Wings hyaline, tinged with yellow; the forewing beyond the cells, but not including the extreme apical margin, faintly fuscous. Head and thorax with a dull white decumbent pubescence, long and dense on the epinotum where it is arranged in close transverse rows directed laterad on each side of the middle line; below the pubescence there are traces of transverse striae. Clypeus two and a half times wider than long, the apical margin shallowly concave. Inner orbits parallel, slightly convergent on the vertex. Interocular distance at the base of the eyes one-fifth greater than on the vertex, where it is equal to the length of the first two joints of the flagellum plus one-sixth of the third joint. Posterior ocelli three-fifths farther from each other than from the eyes. Flagellum slender, the second joint nearly five and a half times longer than wide at the apex. Pronotum about two and a third times wider than long (measured tangentially), the hind margin arcuate. Postnotum one-fourth as long in the middle as the metanotal disk, transversely striate. Epinotum with a fine median longitudinal carina, the dorsum gibbous, merging gradually into the steep declivity which is about twice as long as the dorsum, and flat. The dorsum is three times wider than long. The proportions of the first three abscissae of the radius are as 3:11:8; the third cubital cell is twice as long on the cubitus as on the radius. Transverse anal vein of the hindwing prefurcal.

Tillembeya, River Niger, French Sudan, 14 August 1944, 1 ♀.

Easily recognized by the peculiar arrangement of the pubescence of the epinotum and its flattened and wide declivity.

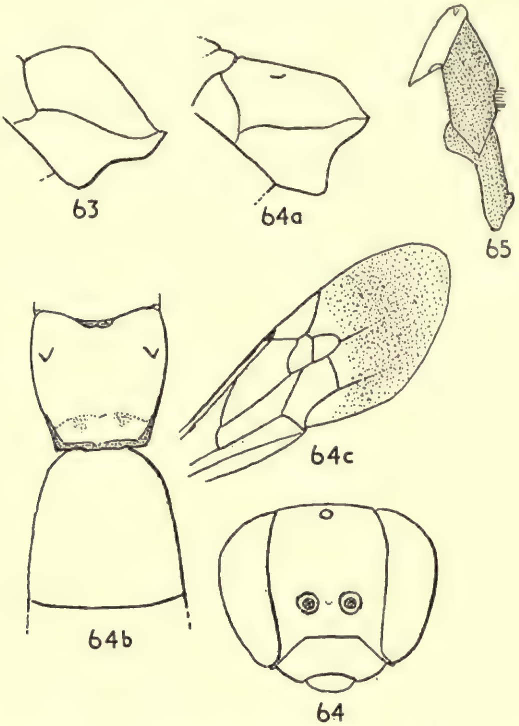


Fig. 63. *Pompilus contrarius* ♀, epinotum, ×*c.* 15. Fig. 64. *P.* (*Pilompus*) *levis* ♀, head, ×*c.* 15. Fig. 64*a*. *P.* (*Pilompus*) *levis*, epinotum, ×*c.* 15. Fig. 64*b*. *P.* (*Pilompus*) *levis*, epinotum and first tergite, ×*c.* 15. Fig. 64*c*. *P.* (*Pilompus*) *levis*, wing, ×12. Fig. 65. *Ceropales variolosus* ♂, left stipes, dorsal view, ×27.

PILOMPUS subgen. n. (anagram **Pompilus**)

Characters

♀. Anterior tarsi without a comb, all the claws bifid, the pulvillus small with a comb of about nine cilia. Clypeus not strap-like and much wider than long as in *Pompilus*, but narrow, more or less hexagonal (Fig. 64), and as wide as the bottom of the face. First tergite wide at the base, not much narrower there than at the apex. Otherwise like *Pompilus*.

Subgenotype, *P. levis* Arnold.

Pilompus levis sp. n.

(Figs. 64, 64*a–c*)

♀. 8·5 mm. long. Black. Palpi ochreous. Wings hyaline, the forewing beyond the cells pale fuscous. Head, thorax, and legs with a very fine pruinose pubescence; the basal two-thirds of the first tergite and the basal half, more or less, of the second to fourth tergites with a similar pubescence. Clypeus two and a third times wider than long, the anterior margin concave and twice as long as the lateral margins. Palpi short. Inner orbits divergent over the middle third of their length. Interocular distance on the vertex equal to the length of the first two joints of the flagellum plus one-third of the third joint. Posterior ocelli twice as far from each other as from the eyes. Flagellum fairly stout, the second joint barely three times longer than wide at the apex and as long as the third joint.

Occiput nearly flat, its junction with the vertex widely rounded. Pronotum twice as wide behind as long in the middle, the hind margin obtusely angular, the dorsal and anterior face forming an unbroken arc in profile. Mesonotum as long as the pronotum. Postnotum about half as long in the middle as the feebly convex metanotal disk, linear at the sides. Epinotal dorsum widest across the middle, seven-ninths wider there than long, nearly twice as long as the oblique declivity which is nearly flat transversely. First tergite as long as wide behind, only three-fourths wider there than at the base. Anterior tarsi with a few short spines on the outside; posterior tibiae with two rows of three spines each on the upperside. Third cubital cell petiolate, the petiole half as long as the second abscissa of the radius; the proportions of the three abscissae are as 6:4:10. First transverse cubital vein strongly curved inwards, the pterostigma very small, the nervulus postfurcal. Transverse anal vein of the hindwing slightly prefurcal.

Aburi, Gold Coast, December 1941, 1 ♀.

Subfamily CEROPALINAE

Ceropales variolosus Arnold

(FIG. 65)

1947, *Ann. Transv. Mus.* **19**: 87, ♀.

♂. 7·5 mm. long (hitherto undescribed). Sixth and seventh abdominal segments yellow. Puncturation of the face less close than in the ♀, the punctures arranged in transverse rows, the spaces between the rows about twice as wide as the punctures. Clypeus two and a half times wider than long. The proportions of the first three abscissae of the radius are as 5:11:15. The outer paramera of the genitalia have the shape of a flattened fish-hook, with the acute, triangular, and transparent barb on the inside.

Accra, Gold Coast, September 1941, 2 ♂♂, 1 ♀; Diafarabé, French Sudan, August 1944, 1 ♀.

The colour is variable. In the other ♂ specimen and in the ♀ from Diafarabé the red parts of the head and thorax are replaced with black.

Ceropales latifasciatus Arnold

1937, *Ann. Transv. Mus.* **19**: 92.

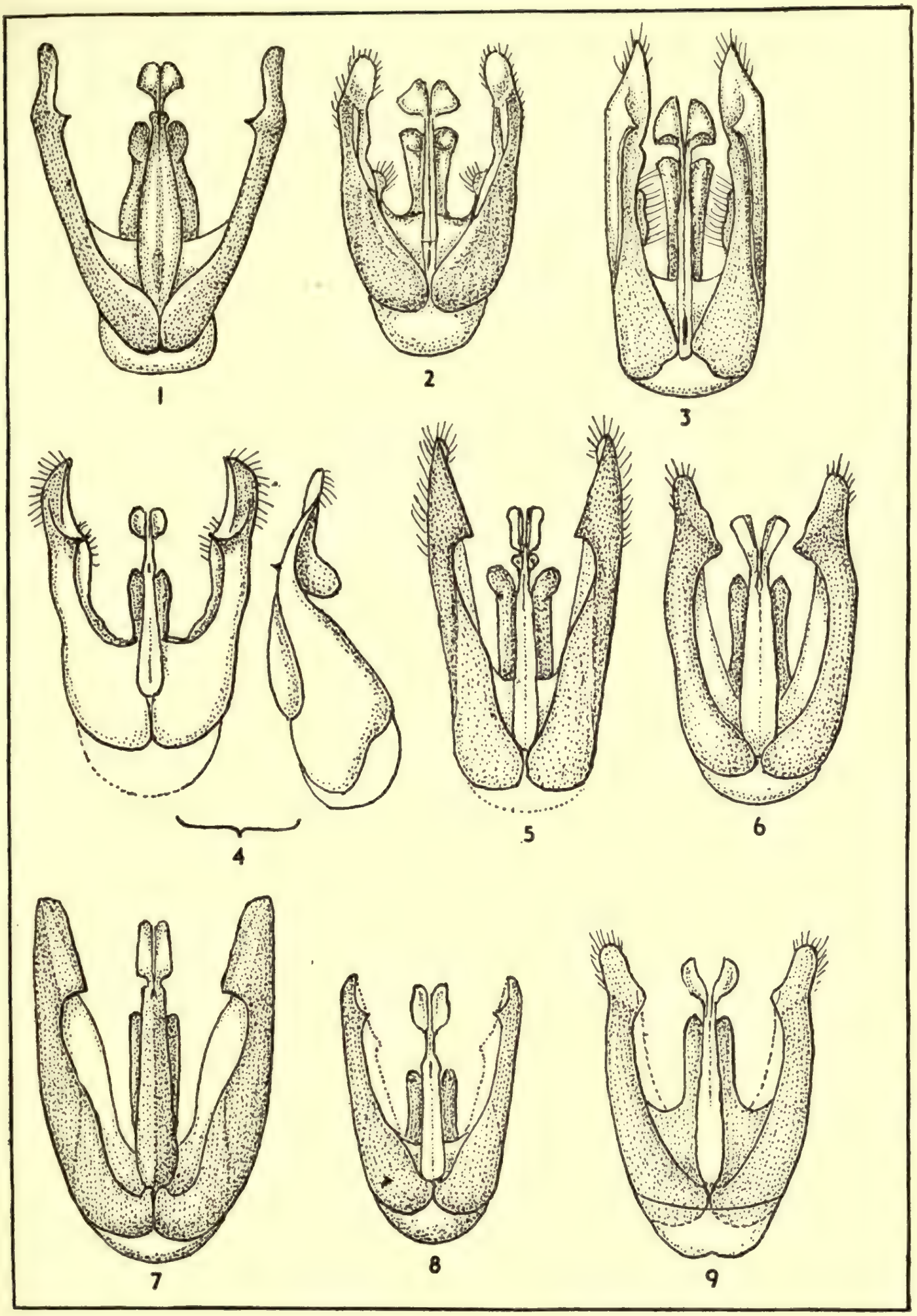
Lekempti, Haramaia, and Cencia, Ethiopia, April–May 1948, 3 ♂♂.

PRESENTE

PLATE 4

GENITALIA

Fig. 1. *Cerceris guichardi*, ×25.
Fig. 2. *Cerceris moggionis*, ×25.
Fig. 3. *Cerceris insignita*, ×30.
Fig. 4. *Cerceris bicolor*, ×28.
Fig. 5. *Cerceris zavattarii* var., ×33.
Fig. 6. *Cerceris rhodesiae*, ×36.
Fig. 7. *Cerceris campsomeroides*, ×30
Fig. 8. *Cerceris faceta*, ×42.
Fig. 9. *Cerceris flavonasuta*, ×30.

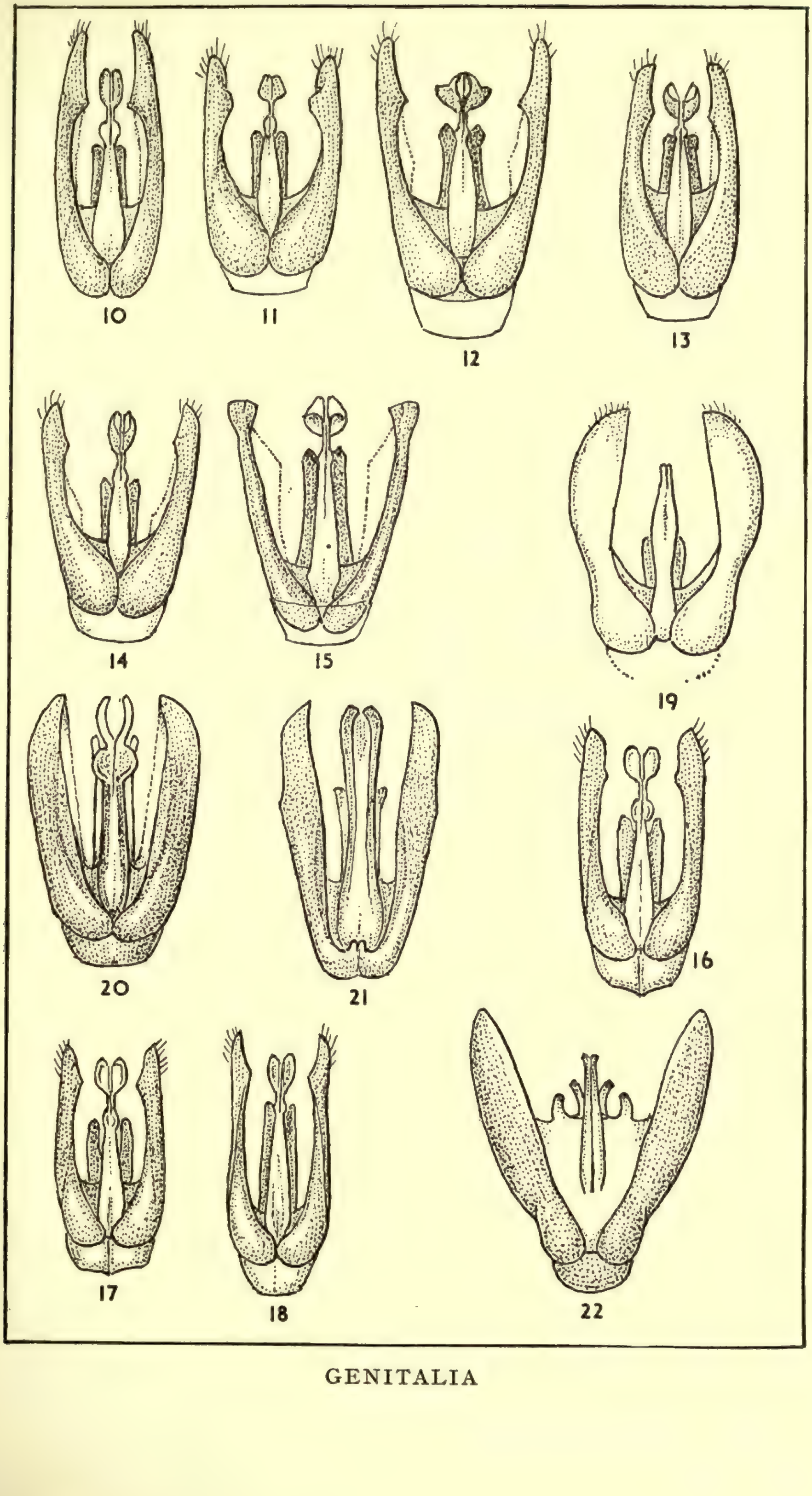


GENITALIA

PLATE 5

GENITALIA

Fig. 10. *Cerceris maia*, ×42.
Fig. 11. *Cerceris alcyone*, ×42.
Fig. 12. *Cerceris merope*, ×40.
Fig. 13. *Cerceris sterope*, ×42.
Fig. 14. *Cerceris celaeno*, ×60.
Fig. 15. *Cerceris taygete*, ×40.
Fig. 16. *Cerceris nugax insularis*, ×25.
Fig. 17. *Cerceris nugax*, ×25.
Fig. 18. *Cerceris yungvei*, ×40.
Fig. 19. *Alysson guichardi*, ×60.
Fig. 20. *Nysson quadricolor*, ×40.
Fig. 21. *Brachystegus senegalensis*, ×25.
Fig. 22. *Gorytes thalia montivagus*, ×42.


10
11
12
13
14
15
19
20
21
16
17
18
22

GENITALIA

PRESENTED
17 DEC 1951

PRINTED IN
GREAT BRITAIN
AT THE
UNIVERSITY PRESS
OXFORD
BY
CHARLES BATEY
PRINTER
TO THE
UNIVERSITY

7 FEB 1952

A COLLECTION OF FLEAS FROM THE BODIES OF BRITISH BIRDS

WITH NOTES ON THEIR DISTRIBUTION AND HOST PREFERENCES

MIRIAM ROTHSCHILD

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 2 No. 4
LONDON : 1952

A COLLECTION OF FLEAS FROM THE BODIES OF BRITISH BIRDS

WITH NOTES ON THEIR DISTRIBUTION AND HOST PREFERENCES

BY

MIRIAM ROTHSCHILD

Pp. 185–232; 3 Text-figures

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 2 No. 4
LONDON : 1952

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in 1949, is issued in five series, corresponding to the Departments of the Museum.*

Parts will appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, No. 4, of the Entomology series.

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued February 1952 *Price Ten Shillings*

NATURAL HISTORY

A COLLECTION OF FLEAS FROM THE BODIES OF BRITISH BIRDS, WITH NOTES ON THEIR DISTRIBUTION AND HOST PREFERENCES

By MIRIAM ROTHSCHILD

With three text-figures

SYNOPSIS

Ten species of fleas (143 specimens) were collected from the bodies of 36 species (74 specimens) of British birds. There are single records of *Ceratophyllus styx* (2 specimens), *C. hirundinis* (10 specimens), *C. columbae* (1 specimen), *C. vagabunda* (2 specimens), *Nosopsyllus fasciatus* (1 specimen), and *Orchopeas wickhami* (1 specimen). There are 2 records of *C. rusticus* (26 specimens), 3 records of *C. garei* (4 specimens), 32 records of *C. gallinae* (52 specimens), and 36 records of *Dasypsyllus g. gallinulae* (44 specimens).

The geographical distribution and host preferences of *C. vagabunda*, *C. garei*, *C. gallinae*, and *D. g. gallinulae* are discussed, and in addition the ratio of fleas found on the body and in the nest of the host and the sex-ratios of the three last-mentioned species are considered. It is shown that fleas may be collected from the bodies of birds at all times of the year, and not only in the breeding-season.

INTRODUCTION

THE fleas discussed in this paper were obtained by Miss Theresa Clay and Colonel Richard Meinertzhagen from the bodies of British birds and have recently been presented to the British Museum (Natural History). The collection numbers 143 specimens, more than double the total bird-fleas taken from the bodies of their hosts (as opposed to nests) in the combined Rothschild, Waterston, and British Museum cabinets. It thus forms the finest collection of its kind in existence, and in an effort to throw some light on various interesting points which it raises, especially concerning the host preferences and distribution of the three commonest bird-fleas, all the British records of these species have been reviewed and are discussed in the following pages.

It is still a general belief that fleas occur only occasionally on the bodies of adult avian hosts. As recently as 1949 O'Mahony writes: 'Two species of fleas have been collected, both from the bodies of the birds—a rare enough circumstance in itself.' It is, of course, true that bird-fleas are essentially nest-dwellers, but in small numbers they occur much more frequently on the host than is generally realized, and this becomes apparent if birds are sealed in containers impregnated with chloroform immediately they are shot and subsequently searched.

The material in the British Museum (N.H.), including the C. Rothschild and J. Waterston Collections, has been listed and the data arranged in Tables 2, 3, and 9 for comparison. Table 3 incorporates records generously supplied by various collectors (see acknowledgements) and additional information obtained from a thorough search of the literature prior to 1947.

Until recently authors have tended to record the common species of bird-fleas in very general terms, which makes an accurate comparison of host–parasite relationships almost impossible. Thus, for example, Jeffrey (1922), who collected over a thousand fleas for Charles Rothschild, records *Ceratophyllus gallinae* 'in great abundance' from the nests of the Fowl (*Gallus domesticus*), Sparrow-Hawk (*Accipiter nisus*), Starling (*Sturnus vulgaris*), and Long-Eared Owl (*Asio otus*); 'in large numbers' from the Swift (*Apus apus*), and so forth. The actual number of positive nests is not supplied, and negative records are ignored altogether. Nor is it possible to arrive at the correct figures by examining the material in the Rothschild Collection itself, for many specimens have been given away and exchanged. Some records of material in the Rothschild Collection were passed on to other collectors for publication. Thus in 1936 I passed all my records of bird-fleas, including those in the C. Rothschild Collection, to G. B. Thompson, who published a quantity of them in his paper 'The Parasites of British Birds and Mammals' (1937*c*). Unfortunately, for some inexplicable reason, he omitted many of them and all the localities and dates. It should be noted that although he included the Honey Buzzard in his list, he did not enter any flea-species under this host! This may have been due to some query raised at the proof stage concerning this very interesting record. The whereabouts of the nest was kept secret by the late Mr. Meade Waldo, who discovered it in Cornwall. The present paper includes all the records of *Ceratophyllus gallinae*, *C. garei*, *C. vagabunda insularis*, and *Dasypsyllus g. gallinulae* which I had passed to G. B. Thompson already at that time. The records of *C. borealis* with full data have been republished by me (Rothschild, 1948). Several of the Scottish records (specimens collected by F. J. Cox and others) were published by Waterston (1914), and consequently care has to be exercised to avoid duplication, since the data on the slides are not always the same as the original data as published (see Table 9). Some slight differences will also be found between the Waterston material listed in Table 9 and in the original papers published by Waterston himself. These discrepancies can be explained by the following facts:

1. A number of specimens must have been given away by Waterston himself, during his lifetime, to other collectors.
2. Some specimens are present in the collection that have not been recorded in print.
3. A few of Waterston's determinations were incorrect. These are principally records of *Ceratophyllus fringillae*, which on re-examination of the specimens proved to refer to *C. gallinae*. Two of these misdeterminations were noted by Waterston himself (1909: 227).
4. Some mislabelling has occurred, particularly when the original labels became illegible through age. Thus in one instance, *Passer domesticus* has been rewritten on the outside of the tube as *Phasianus colchicus*!

In Table 3, column 2, some specimens given away in exchange between 1935 and 1950 are included, as well as material at present in the collection. In Table 9 the specimens actually in the British Museum (N.H.) in June 1950 are listed.

Except in the case of *C. vagabunda*, which is not a common species, records from the continental literature have not been taken into consideration. There are few fleas more difficult to separate than the closely related bird-Ceratophylli, and consequently a large proportion of such records would require corroboration before they could be used. Moreover, the available records for the three common bird-fleas in Britain are quite extensive.

In this paper the host-nomenclature and the arrangement of the families of birds have been adapted from Witherby's *Handbook of British Birds*. Scientific names and authors' names are supplied in the tables, but sometimes omitted in the text, to avoid unnecessary repetition. In recent years many collectors name the subspecies of the bird host, but it has been thought better to adopt a binomial nomenclature in Tables 2, 3, and 9 because many of the subspecific names are open to suspicion. Thus, for example, several specimens of *C. gallinae* in the British Museum collection are recorded from nests of *Corvus monedula monedula* from Northampton and Norfolk in April and May; since this subspecies of the Jackdaw only occurs in Britain as a rare autumn migrant, it is safe to assume that an error has been made either in the identification of the host or in writing out the label. In the case of the collection made by Miss Clay and Colonel Meinertzhagen the identification of the host can be accepted without question, so in Table 1 the trinomials supplied by the collectors are listed in column 1.

Jo Bossanyi and the author made a search of the British literature prior to 1947, including many of the minor publications. After that date only the principal entomological journals have been consulted. There can be little doubt, therefore, that some records have been missed, but it is hoped that the list of authors and references will assist any future research concerned with British bird-fleas. Papers containing British records are starred.

ACKNOWLEDGEMENTS

The following collectors have kindly sent me lists of British bird-fleas from their own collections, many of which records have not hitherto been published, and I should like to thank them for their extremely generous help: H. Britten (45 records); R. B. Freeman (34 records); G. D. Morison (19 records); E. O'Mahony (57 records); G. B. Thompson (19 records); P. Tate (44 records from the Molteno Institute collection, most of which were determined by G. H. F. Nuttall or Charles Rothschild), and F. A. Turk (a number of negative records). I should also like to thank the following museums and institutions for information concerning bird-fleas: Marischal College, Aberdeen; Department of Zoology, University College of Wales, Aberystwyth; The Museum, Altrincham; The Museum, Belfast; The City Museum, Birmingham; The Museum, Blackburn; The Museum, Bradford; The City Museum, Bristol; Sexey's School Museum, Bruton; The Molteno Institute, Cambridge; The National Museum of Wales, Cardiff; The Museum, Carlisle; The Chelmsford and Essex Museum, Chelmsford; The Department of Zoology, University College, Cork; The Museum, Dunfermline; The Museum, Glasgow; The University, Glasgow; The Public Museum, Gloucester; The Belle Vue Museum, Halifax; The Educational Museum, Haslemere;

The Union Lodge Museum, Hawick; The Tolson Memorial Museum, Huddersfield; The Mortimer Museum, Hull; The Fitz Park Trust, Keswick; The Museum, Kettering; The Museum, Kilmarnock; The City Museums, Leeds; University College, Leicester; Littlehampton Museum, Littlehampton; The School of Hygiene Museum, University of Liverpool, Liverpool; The Museum, Mansfield; Marlborough College Natural History Society, Marlborough; The Hancock Museum, Newcastle-upon-Tyne; The Natural History Museum, Nottingham; The Museum, Peebles; The City of Perth Museum, Perth; The Harris Museum, Preston; The Department of Zoology, University of Reading, Reading; Denstone College Museum, Rochester; The Hertfordshire County Museum, St. Albans; The City Museum, Sheffield; The Essex Museum of Natural History, Stratford; The Museum, Sunderland; The County Museum, The Royal Institution of South Wales, Swansea; The County Museum, Truro; The City Museum, Wakefield; The Museum, Warrington; The Museum, Warwick; The Museum, Worthing.

I am also extremely grateful to Jo Bossanyi for searching through 142 of the lesser-known journals and periodicals dealing with British Natural History up to December 1946, and to G. H. E. Hopkins and F. G. A. M. Smit for criticizing the manuscript and supplying records from the literature and unpublished data. G. P. Holland has kindly sent me the new record of *C. vagabunda* from Canada, and with his usual helpfulness and enterprise K. Jordan has succeeded in obtaining several species of bird-fleas from Russia, in order that he could himself verify interesting records of I. Ioff. My remarks on distribution have been criticized by O. W. Richards, and I am most grateful to him for his kindness.

DESCRIPTION OF THE COLLECTION

The collection made by Miss Clay and Colonel Meinertzhagen is listed in Table 1. Ten species of fleas were found distributed among thirty-six species of birds, and of these four are host-specific, and are dealt with first.

TABLE 1

Fleas collected by Colonel Richard Meinertzhagen and Miss Theresa Clay from the Bodies of British Birds

Host	*Species of flea*	*Number and sex*	*Locality and date*
CORVIDAE			
Corvus c. corax L. Raven	*Ceratophyllus gallinae* Schrank (1803)	1 ♀	Shetland, Aug. 1939
	Dasypsyllus gallinulae gallinulae Dale (1878)	1 ♀	Shetland, Aug. 1939
Corvus f. frugilegus L. Rook (18 specimens shot)	*C. gallinae*	1 ♀	Orkneys, Aug. 1938
Corvus monedula spermologus Vieill. Jackdaw	*C. gallinae*	1 ♀	Orkneys, Aug. 1938
(36 specimens shot)	*Ceratophyllus vagabunda insularis* Roths. (1906)	2 ♂	Cornwall, Mar. 1946

TABLE 1—(*cont.*)

Host	*Species of flea*	*Number and sex*	*Locality and date*
STURNIDAE			
Sturnus vulgaris zetlandicus Hart. Shetland Starling	*C. gallinae*	1 ♀	Shetland, Aug. 1938
(135 specimens shot)	*C. gallinae*	1 ♂ 5 ♀	Shetland, Aug. 1939
	Ceratophyllus garei Roths. (1902)	1 ♀	Orkneys, Aug. 1938
	C. gallinae	2 ♂ 2 ♀	North Uist, Aug. 1941
FRINGILLIDAE			
Fringilla coelebs gengleri Kleinschmidt	*D. g. gallinulae*	2 ♂	Dartmoor, Apr. 1940
British Chaffinch	*D. g. gallinulae*	1 ♂	Reading, May 1940
Emberiza citrinella nebulosa Gengler Yellow Hammer	*C. gallinae*	1 ♀	County Kerry, Ireland, Oct. 1945
(56 specimens shot)	*C. gallinae*	1 ♂	Cambridge, May 1941
	C. garei	1 ♀	Cornwall, May 1946
	D. g. gallinulae	1 ♀	Arran, Scotland, Oct. 1943
Emberiza c. calandra L. Corn-Bunting	*D. g. gallinulae*	1 ♀	Cumberland, Apr. 1941
PLOCEIDAE			
Passer d. domesticus (L.) House-Sparrow	*C. gallinae*	1 ♀	Hampshire, Nov. 1944
(35 specimens shot)	*C. gallinae*	1 ♂	Arran, Scotland, Oct. 1943
	C. gallinae	1 ♀	Shetland, Aug. 1939
ALAUDIDAE			
Alauda a. arvensis L. Skylark	*C. garei*	1 ♂ 1 ♀	Cumberland, Apr. 1941
Alauda arvensis theresae Meinertzhagen	*D. g. gallinulae*	1 ♀	Co. Sligo, Ireland, Oct. 1950
MOTACILLIDAE			
Anthus pratensis (L.) Meadow Pipit	*D. g. gallinulae*	1 ♂ 1 ♀	Dartmoor, Apr. 1940
Anthus spinoletta meinertzhageni Bird. Hebridean Rock-Pipit	*D. g. gallinulae*	1 ♂	Sutherlandshire, Apr. 1944
CERTHIIDAE			
Certhia familiaris britannicus Ridgw. British Tree-Creeper	*C. gallinae*	1 ♂	Wales, Jan. 1942
PARIDAE			
Parus major newtoni Prazak British Great Tit	*C. gallinae*	1 ♂ 1 ♀	Cumberland, Apr. 1941
(66 specimens shot)	*C. gallinae*	1 ♂ 2 ♀	Cumberland, Apr. 1941
	D. g. gallinulae	1 ♀	Cumberland, Apr. 1941

TABLE 1—(*cont.*)

Host	*Species of flea*	*Number and sex*	*Locality and date*
Parus major newtoni (*cont.*)	*D. g. gallinulae*	1 ♀	Buckinghamshire, July 1941
	D. g. gallinulae	1 ♀	Reading, June 1941
	D. g. gallinulae	1 ♂	Hampshire, Apr. 1941
	D. g. gallinulae	1 ♂	Cumberland, Apr. 1941
	Orchopeas wickhami Baker (1895)	1 ♂	Berkshire, Mar. 1946
Parus coeruleus obscurus Prazak . British Blue-Tit	*C. gallinae*	4 ♀	Cumberland, Apr. 1941
MUSCICAPIDAE			
Muscicapa s. striata (Pall.) . . Spotted Flycatcher	*C. gallinae*	1 ♀	Hampshire, June 1941
SYLVIIDAE			
Acrocephalus schoenobaenus (L.) . Sedge-Warbler	*D. g. gallinulae*	1 ♀	Hampshire, June 1941
Sylvia n. nisoria (Bechstein) . Barred Warbler	*C. gallinae*	1 ♀	Shetland, Aug. 1939
Sylvia b. borin (Bodd.) . . Garden-Warbler	*C. gallinae*	1 ♂	Shetland, Aug. 1939
Sylvia a. atricapilla (L.) . . Blackcap	*D. g. gallinulae*	1 ♀	Winchester, June 1941
Sylvia c. cinerea Bechstein . . Whitethroat	*D. g. gallinulae*	2 ♀	Reading, May 1940
TURDIDAE			
Turdus philomelos hebridensis . Clarke. Hebridean Song-Thrush	*C. gallinae*	1 ♀	North Uist, Aug. 1941
Turdus m. merula L. . . . Blackbird	*D. g. gallinulae*	1 ♂	Co. Kerry, Ireland, Oct. 1945
	D. g. gallinulae	1 ♂	Arran, Scotland, Oct. 1943
Oenanthe o. oenanthe (L.) . . Wheatear	*D. g. gallinulae*	1 ♀	Orkneys, Aug. 1938
Saxicola torquatus theresae Meinertz. Hebridean Stonechat	*D. g. gallinulae*	1 ♂ 1 ♀	Scilly Isles, Mar. 1943
Erithacus rubecula melophilus Hart. British Robin	*C. gallinae*	1 ♂	Hampshire, Apr. 1941
	C. gallinae	1 ♂	Arran, Scotland, Oct. 1943
	D. g. gallinulae	1 ♂	Arran, Scotland, Oct. 1943
	D. g. gallinulae	1 ♂	Arran, Scotland, Oct. 1943
	D. g. gallinulae	2 ♀	Cumberland, Apr. 1941
	D. g. gallinulae	1 ♂	Hampshire, Apr. 1941
	D. g. gallinulae	1 ♂	Co. Kerry, Ireland, Oct. 1945

TABLE 1—(*cont.*)

Host	*Species of flea*	*Number and sex*	*Locality and date*
PRUNELLIDAE			
Prunella modularis occidentalis (Hart.) British Hedge-Sparrow (90 specimens shot)	*C. gallinae*	1 ♀	Scilly Isles, Mar. 1945
	C. gallinae	1 ♀	Co. Galway, Ireland, Jan. 1947
	C. gallinae	1 ♂	Winchester, June 1941
	D. g. gallinulae	1 ♂ 1 ♀	Winchester, June 1941
	D. g. gallinulae	1 ♀	Cumberland, Apr. 1941
	D. g. gallinulae	1 ♂ 2 ♀	Cumberland, Apr. 1941
	D. g. gallinulae	1 ♂	Co. Galway, Ireland, Jan. 1947
Prunella modularis hebridium Meinertz. Hebridean Hedge-Sparrow	*C. gallinae*	1 ♀	Harris, Outer Hebrides, Nov. 1949
	C. gallinae	1 ♂	N. Uist, Outer Hebrides, Nov. 1949
	D. g. gallinulae	1 ♂	N. Uist, Outer Hebrides, Nov. 1949
TROGLODYTIDAE			
Troglodytes t. troglodytes (L.) Wren	*D. g. gallinulae*	1 ♂	Sutherlandshire, Oct. 1944
	D. g. gallinulae	1 ♀	Co. Kerry, Ireland, Oct. 1945
	D. g. gallinulae	1 ♂	Hampshire, June 1941
	Nosopsyllus fasciatus Bosc. (1800)	1 ♀	Arran, Scotland, Oct. 1943
Troglodytes t. hebridensis Meinertz. Hebridean Wren	*D. g. gallinulae*	1 ♂	Rodel, Harris, Outer Hebrides, Nov. 1949
HIRUNDINIDAE			
Delichon u. urbica (L.) House-Martin (7 specimens shot)	*Ceratophyllus rusticus* Wagner (1903)	13 ♂ 12 ♀	Wiltshire, Aug. 1946
	C. rusticus	1 ♀	Wiltshire, Aug. 1946
	Ceratophyllus hirundinis Curtis (1826)	5 ♂ 5 ♀	Wiltshire, Aug. 1946
Riparia r. riparia (L.) Sand-Martin (2 specimens shot)	*Ceratophyllus styx* Roths. (1900)	2 ♂	Inverness, Aug. 1941
PICIDAE			
Dryobates major anglicus (Hart.) British Great Spotted Woodpecker	*C. gallinae*	1 ♂	Berkshire, Mar. 1946
STRIGIDAE			
Athene noctua vidalii Brehm. Little Owl	*C. gallinae*	3 ♂ 3 ♀	Hampshire, June 1941
FALCONIDAE			
Accipiter n. nisus (L.) Sparrow-Hawk	*C. gallinae*	1 ♂	Suffolk, date unknown

TABLE 1—(*cont.*)

Host	*Species of flea*	*Number and sex*	*Locality and date*
HYDROBATIDAE			
Fulmarus g. glacialis (L.) Fulmar Petrel	*D. g. gallinulae*	1 ♀	Orkneys, Aug. 1938
COLUMBIDAE			
Columba l. livia Gm. Rock-Dove	*C. gallinae*	2 ♀	Shetland, Aug. 1939
	C. gallinae	1 ♀	North Uist, Aug. 1941
	Ceratophyllus columbae Walck. & Gerv. (1844)	1 ♂	Ross of Mull, Feb. 1944
RALLIDAE			
Gallinula c. chloropus (L.) Moorhen	*D. g. gallinulae*	1 ♀	Orkneys, Aug. 1938
TETRAONIDAE			
Lagopus s. scoticus (Lath.) British Red Grouse	*C. gallinae*	1 ♀	Orkneys, Aug. 1938

A. HOST-SPECIFIC SPECIES

1. *Ceratophyllus styx* Rothschild, 1900. This strictly host-specific flea swarms in the burrows of the Sand-Martin (*Riparia r. riparia*), and according to Evans (1904) and Waterston (1916), both sexes overwinter in the nest as pupae or imagines. Jolley and Storer (1945) record that 20 per cent. of nestling Sand-Martins were found to be infested, but the two males collected by Colonel Meinertzhagen (Table 1) appear to be the first recorded from the adult bird. Owing to the large numbers of *C. styx* present in individual nests, and the fact that it is sometimes found 'free' in sand quarries far removed from a nest, it is surprising that it is not collected more often as a straggler on other hosts. There are four records from nests of the Dipper (*Cinclus cinclus*) in Britain (Rothschild, 1915; Britten, 1920; and Walsh, 1938), and Mr. Edward Armstrong informs me that this bird's habits might well bring it into contact with this flea, since it has been known to roost in disused Sand-Martin burrows. Mr. H. Britten has kindly sent me a record of *C. styx* from the nest of the Redstart (*Phoenicurus phoenicurus*) collected by F. Taylor at New Mill, Cheshire, 1921, but unfortunately neither he nor I have had the opportunity of examining this particular specimen.

Further collecting from the nests of the Sand-Martin, especially in northern Scotland, is most desirable. Up to the time of writing *C. styx* is the only species recorded from this host in Britain. Recently Miss Clay has collected several specimens of *C. riparius* Jordan & Rothschild, 1920, and *Frontopsylla lapponica* Nordberg, 1934, from the nest of the Sand-Martin in north-east Sweden. The former species has hitherto been known as the host-specific flea of the Sand-Martin (*Riparia r. riparia*) in North America (including Canada), and there are also records from Trans-Baikal (several specimens in the C. Rothschild collection received from I. Ioff and the determinations checked by K. Jordan). It is also possible that *C. riparius* will be discovered in burrows of the Sand-Martin in northern Scotland, since the ranges of this species and of *C. styx* probably overlap at some point in north Europe. *F. lapponica* may also occur in Scotland; the only other record is from Finland.

2 and 3. *Ceratophyllus hirundinis* Curtis, 1826, and *Ceratophyllus rusticus* Wagner, 1903. It is a well-known fact that the nests of the House-Martin (*Delichon u. urbica*) are richer in fleas, both as regards species and actual numbers, than those of any other bird in Britain (Waterston, 1910; M. Rothschild, 1947; and Allan, 1950). It is therefore not surprising to find that the highest number of fleas collected off an individual host came from the House-Martin: Colonel Meinertzhagen found twenty-five specimens of *C. rusticus* on one bird and ten of *C. hirundinis* on another.

It is a point of considerable interest that *C. hirundinis* is confined to the House-Martin in Great Britain, although it is apparently found in nests of the Swallow (*Hirundo rustica*) on the continent of Europe (Wagner, 1930). In the British Museum collection there are three specimens of *C. hirundinis* and one of *C. rusticus* obtained in different parts of Germany in nests of the Swallow, apart from the numerous records from the continental literature which include an exceptionally heavy infestation of *C. hirundinis*—2,000 specimens—from one nest. It seems unlikely that all the existing records from this host can be attributed to careless collecting or misidentification of the host. The same may be said of *C. rusticus*, which has only once been recorded from the Swallow in Britain (Rothschild, 1947), and until recent years was considered a rare flea in this country.

The distribution of House-Martin fleas in general presents certain baffling problems. Judging from their flea fauna, it seems possible that relatively small communities of these birds must remain isolated over long periods of time, and the distribution of *C. hirundinis* and *C. rusticus* suggests the same may apply in a lesser degree to the Swallow. In the east of Scotland *Orneacus waterstoni* (Jordan) 1925 and *Frontopsylla laetus* (Jordan & Rothschild) 1920 have been recorded from the nests of the House-Martin. These fleas appear to be absent from England and Eire and over the larger part of Europe, but occur in the Swiss Alps. A related species of *Orneacus* is recorded from the Himalayas. The presence of *Orneacus* and *Frontopsylla* in these nests and their absence elsewhere may be due to climatic changes in the past, and could also be governed by some temperature or humidity requirements of the larvae, but it nevertheless seems unlikely that this factor alone accounts for the distribution of these fleas and prevents a secondary spread southwards on the House-Martin. It is obvious in the case of *C. hirundinis*, which in Britain pullulates in the nests of the House-Martin breeding in the same district as the Swallow, that this cannot be the only explanation why it is not found in nests of the latter species.

It is also worth noting that the exchange of fleas between Sparrows and House-Martins appears to be entirely one-sided in Britain. *Ceratophyllus gallinae* (Schrank) 1803 and *Ceratophyllus fringillae* (Walker) 1856 are found from time to time in the nest of the latter (Evans, 1906; Waterston, 1906; Bagnall, 1921; and Rothschild, 1947), but no House-Martin fleas seem to survive on Sparrows. There is, however, one specimen of *C. hirundinis* from a House-Sparrow in Germany in the C. Rothschild collection.

4. *Ceratophyllus columbae* (Walckenear & Gervais) 1844. The Domestic Pigeon and the Rock-Dove (*Columba l. livia*) are infested, in Europe, with a host-specific flea,

C. columbae, which is absent, however, from the dove-cots of the U.S.A. (Jordan, 1923; Rothschild, 1952 in press). The collection contains one male of this species from a Rock-Dove shot in Ross of Mull. On two occasions *C. gallinae* was taken from the Rock-Dove, and it is this species which infests the domestic pigeon in the Eastern United States. It should be noted that *C. columbae* is not a parasite of the Wood-Pigeon (*Columba palumbus* L.) as stated by G. B. Thompson (1937). There are no records from this bird, except Thompson's own record from a London Wood-Pigeon, which had presumably come into close contact with domestic pigeons.

B. Species which are not Host-specific, but show some Host-preference

Ceratophyllus vagabunda insularis Rothschild, 1906. Two male specimens of *C. vagabunda insularis* were obtained from a Jackdaw (*Corvus monedula spermologus* Vieillot) shot in Cornwall (see also O'Mahony, 1948: 89). This flea has an interesting distribution, and also displays a somewhat peculiar choice of hosts, favouring three widely separated groups of birds, the Corvidae, Laridae, and Order Falconiformes. Since *C. vagabunda* has broken up into subspecies (Jordan, 1926) of which *C. v. insularis* is peculiar to the British Isles, we may deduce that it is a relatively ancient form. The species as a whole displays an alpine-boreal distribution, occurring in Alaska, Canada, Spitzbergen, Great Britain, Sweden, Finland, Turkestan, Siberia, and the Swiss Alps (Jordan, 1932). Recently there has been a record from Belgium (Cooreman, 1947), but F. G. A. M. Smit and F. Peus (personal communications) have failed to find it in nests in Holland and Germany, although between them they have examined over one hundred Gulls' nests and also Jackdaws' nests. This type of distribution is reminiscent of that of *C. borealis*, only *C. vagabunda* is not markedly restricted to islands (Rothschild, 1948).

A glance at Table 2, listing the specimens in the British Museum and other British records together with their hosts, shows that a wide variety of birds may be infested. In the 'Synopsis of the British Siphonaptera' (Rothschild, 1915) this flea is described as 'a rare species frequenting the nests of sea birds', and the statement is widely quoted in the literature. There are, however, five other records from the Jackdaw in Britain (O'Mahony, 1948, and Table 2), and it will be noted that those listed in Table 2 were taken far inland in Northamptonshire, Midlothian, and Herefordshire. The male from which the British subspecies of the flea was originally described (Rothschild, 1906) was obtained from a hollow tree in Reading, Berkshire, which had been used successively by Woodpecker, Owl, and Starling. It is more than likely that this hole had also been occupied by Jackdaws at one time or another. The same may be said of the hollow tree at Hampton Court, Middlesex, in which a specimen of *C. vagabunda* was found inside a *Crataegus* seed in the store of *Mus* sp. (Waterston, 1923). There is also a record of this species from the Jackdaw in Sweden (Wahlgren, 1903 and 1907) and Belgium (Cooreman, 1947), one from the Magpie (*Pica pica*) at Ashton, Peterborough, one from the Raven (*Corvus corax*) on Inishtrahull (O'Mahony, 1941), and the host of *C. v. alpestris* in the Swiss Alps is also a Corvid, the Mountain Chough (*Pyrrhocorax graculus*). In Finland Nordberg records it from no less than 100 per cent. of the Jackdaws' nests which he examined—fifty-seven in all—and Cooreman concluded from this that the Jackdaw was probably

TABLE 2

Records of C. vagabunda *Boheman (1866)*

Name of host (all from nests unless otherwise stated)	*Localities*	*Total No. of records for each host*		*Location of specimens*	*First published record*
CORVIDAE					
Corvus corax L. Raven	Inishtrahull Isles, Co. Donegal (Eire)	1		Nat. Mus. Dublin	O'Mahony, 1941
Corvus monedula L. Jackdaw	Cornwall (England)	1	69	R. Meinertzhagen Coll. (det. M. Rothschild)	O'Mahony, 1948
	Treago Park, Hereford (England)	2*		E. O'Mahony Coll.	O'Mahony, 1948 and present paper
	Colinton, Midlothian (Scotland)	3†		B.M. (J. Waterston Coll.)	Waterston, 1906 (as *C. insularis* Roths.)
	Ashton, Peterborough (England)	3		B.M. (C. Rothschild Coll.)	Present paper,‡ and O'Mahony, 1948
(Recorded as *Coloeus monedula*)	Sweden	1		Probably Wahlgren Coll.	Wahlgren, 1907 (as *C. monedulae*)
(Recorded as *Coloeus monedula*)	Towns and villages in Finland	57		Unknown	Nordberg, 1934
(Recorded as *Coloeus monedula*)	Godinne (Belgium)	2§			Cooreman, 1947
Pica pica (L.) Magpie (labelled *Pica rusticus*)	Ashton, Peterborough (England)	1		B.M. (C.R. Coll.)	Present paper
Pyrrhocorax graculus L. Mountain Chough	Above Findelen, Zermatt (Switzerland)	1		B.M. (C.R. Coll.) (Type of Alpine subspecies *C. vagabunda alpestris* J. 1926)	Jordan & Rothschild, 1920
STRIGIDAE					
Bubo bubo (L.) Eagle-Owl	Jomala (Finland)	1		Unknown	Nordberg, 1934
Strix aluco L. Tawny Owl	Arniston, Midlothian (Scotland)	1		B.M. (J.W. Coll.)	Present paper
FALCONIDAE					
Falco peregrinus Tunst. Peregrine Falcon	Tintagel, Cornwall (England)	1		B.M. (C.R. Coll.)	Present paper
	Finland	1		Unknown	Nordberg, 1936
ACCIPITRIDAE					
Aquila chrysaëtus (L.) Golden Eagle (From nest and nestlings)	Rapids, Alaska	1		Rocky Mountain Lab., Hamilton, Montana (det. Karl Jordan; seen by M. Rothschild) ‖	Phillip, 1938

* One of these records has not been published by E. O'Mahony.

† In Waterston's (1906) paper three separate collections are given with dates and the comment 'common in the nest of *Corvus monedula*'. The specimens in the British Museum are dated 7.5.06 and 24.5.06, and those of 19.6.06 are missing.

‡ There is no way of ascertaining whether Thompson (1937) included this record or not in his list, since he does not indicate the source of his data. This also applies to several of the other specimens which are entered in this column as 'first published record in the present paper'.

§ The record reads 'found in numbers in the nests of *Coloeus monedula*', but we have only counted it as two records.

‖ Unless otherwise stated only the specimens in the British Museum collection have been seen by the author.

TABLE 2—(*cont.*)

Name of host (all from nests unless otherwise stated)	*Localities*	*Total No. of records for each host*		*Location of specimens*	*First published record*
Buteo buteo (L.) Common Buzzard	Finstrom, Finland	1		Unknown	Nordberg, 1934
Accipiter nisus (L.) Sparrow-Hawk	Jomala, Finland	1		Unknown	Nordberg, 1934
Pernis apivorus (L.) Honey-Buzzard	Cornwall (England)	1		B.M. (C.R. Coll.)	Present paper
ANATIDAE					
Anser brachyrhynchus Baillon Pink-footed Goose	Advent Bay, Spitzbergen	1	2	B.M. (C.R. Coll.)	Jordan, 1932
(Recorded as *Melanonyx brachyrhynchus*)	Spitzbergen	1		Unknown	Dampf, 1911
Branta leucopsis (Bechst.) Barnacle-Goose	Advent Bay, Spitzbergen	1		B.M. (C.R. Coll.)	Jordan, 1932
PHALACROCORACIDAE					
Phalacrocorax carbo (L.) Cormorant (Recorded as Cormorant)	Farne Islands, Northumberland (England)	1		R. S. Bagnall Coll.	Bagnall, 1921
Phalacrocorax aristotelis (L.) Shag	Bodd and Stoil, Canna Isle (Scotland)	1	2	Glasgow Univ. Coll. (det. K. Jordan)	Carrick, 1939
(From nest and nestlings)	Lambay Island (Eire)	1		E. O'Mahony Coll.	O'Mahony, 1945
PROCELLARIIDAE					
Fulmarus glacialis (L.) Fulmar Petrel	St. Kilda (Scotland)	1		B.M. (J.W. Coll.)	Waterston, 1906 (as *C. insularis*)
COLUMBIDAE					
Columba livia Gm. Rock-Dove	Cave in cliff, Todhead, Kinneff (Scotland)	1		B.M. (J.W. Coll.)	Present paper
LARIDAE					
Larus argentatus Pont. Herring-Gull	Burwick, Orkney Isles (Scotland)	1	23	B.M. (J.W. Coll.)	Waterston, 1906 (as *C. insularis*)
	Cliffs near Todhead, Kinneff (Scotland)	2		B.M. (J.W. Coll.)	Waterston, 1910
	Ireland's Eye, Co. Dublin (Eire)	6**		E. O'M. Coll.	O'Mahony, 1941, and present paper
	Casana Rock, Howth, Co. Dublin (Eire)	1		E.O'M. Coll.	O'Mahony, 1939
	Lambay Isle (Eire)	2**		E.O'M. Coll.	O'Mahony, 1939, and present paper
	Cruden Bay (Scotland)	6			Allan, 1950
	Portlethen, Kincardineshire (Scotland)	3			Allan, 1950
	Muchalls, Kincardineshire (Scotland)††	2			

** Five of these records and one of those from Lambay Isle are published here for the first time.

†† The record says 'nests', but as no numbers are given this is treated as two records.

TABLE 2—(*cont.*)

Name of host (all from nests unless otherwise stated)	*Localities*	*Total No. of records for each host*	*Location of specimens*	*First published record*
Larus hyperboreus Gunn. The Glaucous Gull (Recorded by Wagner as *Larus glaucus*)	North Siberia	1 } 2	Unknown. (Type of subspecies *C. vagabunda orientalis*‡‡ Wagner, 1929)	Wagner, 1929
	Kidliut Bay, North-West Territory (Canada)	1	B.M. and G. P. Holland Coll. (det. G. P. Holland and K. Jordan)	Present paper
Rissa tridactyla (L.) Kittiwake	Isle of May (Scotland)	2 } 3	B.M. (C.R. Coll.)	Rothschild, 1915
	Great Skellig, Co. Kerry (Eire)	1	Nat. Mus. Coll. Dublin	O'Mahony, 1941
Pagophila eburnea (Phipps) Ivory Gull (From nestling in nest)	Spitzbergen	1	B.M. (C.R. Coll.)	Present paper
ALCIDAE				
Fratercula arctica (L.) Puffin	Sheep Island, off Ballintoy (Eire)	1 } 2	G. B. Thompson Coll.	Thompson, 1937
	St. Kilda (Scotland)	1	B.M. Coll. (received from D. J. McCrae)	Present paper
DOMESTIC POULTRY				
Gallus domesticus L. Domestic Fowl (From nest?)	Djarkent, Turkestan	1 } 2	B.M. (C.R. Coll.)	Waterston, 1923, and present paper
	Narankol, Turkestan	1		
MAMMALIAN HOST				
Apodemus tscherga (= *Apodemus s. tscherga* Kasts.)	Djarkent, Turkestan	1	B.M. (C.R. Coll.)	Waterston, 1923
UNCLASSIFIED HOSTS				
A hole in a tree occupied successively by Starling, Woodpecker, and Owl	Near Reading, Berkshire (England)	1	B.M. (C.R. Coll.). (Type specimen of British subspecies *C. vagabunda insularis* Rothschild, 1906)	Rothschild, 1906
Inside seed of *Crataegus* in store of *Mus* sp. in hollow tree	Hampton Court, Middlesex (England)	1	B.M. (J.W. Coll.)	Waterston, 1923
Nests of sea-birds	Shetland Isles (Scotland)	Several	B.M. (J.W. Coll.)	Waterston, 1914
Coming down the rocks	St. Kilda Isle (Scotland)	1	B.M. (J.W. Coll.)	Waterston, 1906 (as *C. insularis*)
On the ground? (no data)	Farne Islands, Northumberland (England)	1	B.M. (C.R. Coll.)	Present paper
Off clothing	Klass Billen Bay, Spitzbergen	1	B.M. (C.R. Coll.)	Present paper

‡‡ The author has not seen this specimen, but judging from the description its status as a subspecies appears doubtful.

TABLE 2—(*cont.*)

Name of host (all from nests unless otherwise stated)	*Localities*	*Total No. of records for each host*	*Location of specimens*	*First published record*
Jumping about on the ground	Kap Todsen, Isfjorden, Spitzbergen	4	Reichsmus., Stockholm. (Type of arctic subspecies *C. vagabunda vagabunda* Boheman, 1866; seen by M. Rothschild)	Boheman, 1866 (as *C. digitalis* Wahlgren, 1903)
Herbage (about 50 ft. below gull's nest)	Muchalls, Kincardine (Scotland)	1	G. D. Morison Coll.	Present paper

the 'normal host for this flea'. Nordberg also found it in one nest each of the Eagle Owl (*Bubo bubo*), the Buzzard (*Buteo buteo*), the Peregrine Falcon (*Falco peregrinus*), and the Sparrow-Hawk (*Accipiter nisus*).

The tendency to favour birds of prey (Falconidae and Accipitridae) may be observed in Great Britain, where *C. vagabunda* has been collected from the nests of the Peregrine Falcon and the Honey-Buzzard (*Pernis apivorus*). In Alaska it was taken from a nest of the Golden Eagle (*Aquila chrysaëtus*). An equally favoured group of birds appears to be the Gulls. There are twenty-two records from the Herring-Gull (*Larus argentatus*) in Britain, two from the Kittiwake (*Rissa tridactyla*), one from the Ivory-Gull (*Pagophila eburnea*) in Spitzbergen, and the Glaucous Gull (*Larus hyperboreus*) in Siberia, and in Canada (see Table 2).

Characteristics common to these hosts are difficult to find. A large proportion of them build on precipitous rocks or cliffs, and the Corvidae, certain birds of prey, and various Gulls, as well as the Shag and Cormorant (Table 2), construct large, bulky nests. It is obvious, however, from a glance at the list of hosts that neither of these requirements is essential to *C. vagabunda*.

It is often assumed that species which display a so-called fringing or relict distribution, like *C. vagabunda*, were once distributed widely over the Continent, but were restricted to their present limited area during or following one of the ice ages. With this possibility in mind it is tempting to speculate on the identity of the true host of *C. vagabunda* in the past. The Choughs (*Pyrrhocorax*) instantly spring to mind. These birds, which build bulky nests on rocky and precipitous cliffs, were undoubtedly more widely distributed in the past. Moreover, the Mountain Chough is the host of *C. v. alpestris* in the Alps, and the fairly closely related Jackdaw is the favoured host inland in Europe today.

It would be a relatively easy task, and an interesting one, to trace the distribution of *C. vagabunda* on the Jackdaw in Europe. It seems possible that at the present time there is a secondary spread of this flea southwards again on this particular host. Another point of interest is whether the north European subspecies, *C. v. vagabunda*, is present on migrating Jackdaws which visit this country. There is every reason to suppose that it is, and during the winter months both subspecies are probably to be found in Great Britain.

It is perhaps worth noting that a relatively high proportion of records of *C. vagabunda* are of 'free' specimens, that is to say specimens collected away from any particular host: 'Jumping about on the ground'; 'Off clothing'; 'Coming down the rocks'; 'Inside a *Crataegus* seed', and so forth (Boheman, 1866; Waterston, 1923, and Table 2). The impression is created that certain areas such as sea cliffs in particular districts, for example the east coast of Ireland (O'Mahony, 1949) or the Tintagel district in Cornwall, are infested with these fleas, which possibly migrate from the nests if the temperature falls, or when they become hungry (Waterston, 1910; Nordberg, 1936; and Ioff, 1946), and in due course wander on to other species of birds nesting in the vicinity which will also serve as hosts.

If indeed *C. vagabunda* is a 'relict' species, reduced to a mere fringe of its former distribution either by climatic changes or by the gradual elimination of its principal host, it may owe its survival to the crowded breeding conditions on rocky cliffs along the coast, and to its ability to spread without being actually carried on the body of the host to its nest.

C. Species which are not Host-specific and show little or no Host-preference

1. *Ceratophyllus garei* Rothschild, 1902. In this collection there are only three records of *C. garei* (Table 1), compared with thirty-three of *C. gallinae* and thirty-five of *Dasypsyllus gallinulae gallinulae* (Dale) 1878. The ratio of *C. garei* to the other two common bird-fleas in this collection is therefore unusually low, approximately 1:22 instead of the expected 1:6, as shown in the overall records in Table 4. There are two probable explanations to account for this fact. Out of the thirty-six species of birds shot by Colonel Meinertzhagen, twenty-nine are of the Order Passeriformes. It will be seen from Table 4 that out of a total of 108 records of *C. garei* only 35 per cent. are from Passerine birds, whereas 86 per cent. of records of *C. gallinae* and no less than 92 per cent. of records of *D. g. gallinulae* are from this order. The second reason for the relatively small number of *C. garei* is the fact that this species is apparently less frequently found on the bodies of its hosts than either of the two other common British bird-fleas (Table 4).

The host-preferences of *C. garei* appear to be governed more by the situation of the nest than by any other factor. Nevertheless there are certain features concerning its choice of host which are difficult to explain on the basis of the nesting site or microclimate alone. It must not be forgotten that we only guess at the reason why damp sites are chosen. Since Buxton's excellent work on the biology of *Xenopsylla cheopis* (Buxton, 1938) the most favoured explanation centres round the humidity requirements of the larvae, but no actual experiments have been carried out with *C. garei*. Moreover, very little indeed is known about the actual conditions in the nests of different species of birds, and there are no reliable data available by which we could compare the microclimate of a Linnet's or a Robin's nest.

It will be seen from Table 3 that *C. garei* is the only species of flea which has been recorded from the Anatidae (sixteen records in Britain). There are also thirteen records of this species from the Scolopacidae, from which family there are no records of *C. gallinae* and only two of *D. g. gallinulae*. *C. garei* is also the dominant species

TABLE 3

British Bird Hosts of C. gallinae, C. garei, *and* D. g. gallinulae

(*from the British Museum collections, the literature, and unpublished sources*)

Host	*Source of record*	*C. gallinae*	*C. garei*	*D. g. gallinulae*
Corvus corax L. Raven	Ors.*	2	—	1
Corvus corone L. Carrion-Crow	B.M.	6	1	—
	Ors.	1	—	1
Corvus frugilegus L. Rook	Ors.	1	—	—
Corvus monedula L. Jackdaw	B.M.	9	—	2
	Ors.	3	—	1
Pica pica (L.) Magpie	B.M.	2	—	—
Garrulus glandarius (L.) Jay	Ors.	—	—	1
Sturnus vulgaris L. Starling	B.M.	29	1	4
	Ors.	13	1	2
Coccothraustes coccothraustes (L.) Hawfinch	Ors.	—	—	1
Chloris chloris (L.) Greenfinch	B.M.	1	—	6
	Ors.	1	—	3
Carduelis carduelis (L.) Goldfinch	B.M.	1	1	—
Carduelis spinus (L.) Siskin	Ors.	1	—	—
Carduelis cannabina (L.) Linnet	B.M.	—	2	—
	Ors.	—	1	—
Fringilla coelebs L. Chaffinch	B.M.	3	—	6
	Ors.	2	1	4
Pyrrhula pyrrhula (L.) Bullfinch	Ors.	—	—	1
Emberiza citrinella L. Yellow Bunting	B.M.	2	1	1
	Ors.	2	1	7
Emberiza calandra L. Corn-Bunting	B.M.	—	1	—
	Ors.	—	—	1
Emberiza schoeniclus (L.) Reed-Bunting	B.M.	—	2	1
	Ors.	1	—	—
Passer domesticus (L.) House-Sparrow	B.M.	29	1†	3
	Ors.	17	—	—
Passer montanus (L.) Tree-Sparrow	Ors.	3	—	1
Alauda arvensis L. Skylark	B.M.	2	1	5
	Ors.	—	4	—
Anthus trivialis (L.) Tree-Pipit	Ors.	—	—	1
Anthus pratensis (L.) Meadow-Pipit	B.M.	1	2	3
	Ors.	—	1	2
Anthus spinoletta (L.) Rock-Pipit	B.M.	1	—	1
	Ors.	—	—	1
Motacilla alba yarrelli Gould Pied Wagtail	B.M.	3	2	5
Motacilla cinerea cinerea Tunst. Grey Wagtail	B.M.	—	—	2
	Ors.	—	—	1
Certhia familiaris (L.) Tree-Creeper	B.M.	—	—	1
	Ors.	1	—	2
Sitta europoea L. Nuthatch	B.M.	1	—	—
Parus major L. Great Tit	B.M.	15	—	4
	Ors.	10	—	5
Parus coeruleus L. Blue Tit	B.M.	13	—	2
	Ors.	23	—	2
Parus ater L. Coal-Tit	Ors.	—	—	1
Parus atricapillus L. Willow-Tit	Ors.	1	—	1
Aegithalos caudatus (L.) Long-tailed Tit	B.M.	—	—	1
	Ors.	1	—	2
Panurus biarmicus (L.) Bearded Tit	B.M.	—	2	—
Lanius collurio L. Red-backed Shrike	Ors.	—	—	1
Muscicapa striata (Pall.) Spotted Flycatcher	B.M.	3	—	5
	Ors.	1	—	—
Muscicapa hypoleuca (Pall.) Pied Flycatcher	Ors.	1	—	2
Regulus regulus (L.) Goldcrest	Ors.	1	—	1
Phylloscopus collybita (Viell.) Chiff-chaff	B.M.	1	—	2
Phylloscopus trochilus (L.) Willow-Warbler	B.M.	—	—	3
	Ors.	—	—	5
Phylloscopus sibilatrix (Bechst.) Wood-Warbler	B.M.	—	—	1
	Ors.	1	—	—
Locustella naevia (Bodd.) Grasshopper-Warbler	Ors.	1	2	1
Acrocephalus schoenoboenus (L.) Sedge-Warbler	B.M.	1	—	1
	Ors.	—	—	1

* Includes various unpublished records as well as those from the literature.

† Doubtful host, designated as *Passer* sp.

TABLE 3—(*cont.*)

Host	*Source of record*	*C. gallinae*	*C. garei*	*D. g. gallinulae*
Sylvia nisoria (Bechst.) Barred Warbler	Ors.	1	—	—
Sylvia borin (Bodd.)	B.M.	—	—	1
Garden Warbler	Ors.	1	—	—
Sylvia atricapilla (L.) Blackcap	Ors.	—	—	2
Sylvia communis Lath.	B.M.	—	—	1
Whitethroat	Ors.	1	—	4
Sylvia curruca (L.) Lesser Whitethroat	B.M.	—	—	1
Turdus viscivorus L.	B.M.	1	—	2
Mistle-Thrush	Ors.	3	—	2
Turdus ericetorum Turton	B.M.	4	—	4
Song-Thrush	Ors.	6	3	5
Turdus merula L.	B.M.	16	2	15
Blackbird	Ors.	6	2	12
Oenanthe oenanthe (L.)	B.M.	—	—	1
Wheatear	Ors.	—	1	4
Saxicola torquata (L.)	B.M.	—	—	1
Stonechat	Ors.	—	—	1
Phoenicurus phoenicurus (L.)	B.M.	2	—	3
Redstart	Ors.	1	—	2
Phoenicurus ochrurus (L.) Black Redstart	Ors.	1	—	—
Erithacus rubecula (L.)	B.M.	1	—	14
Robin	Ors.	3	—	19
Prunella modularis (L.)	B.M.	5	1	10
Hedge-Sparrow	Ors.	9	—	7
Troglodytes troglodytes (L.)	B.M.	4	—	8
Wren	Ors.	8	—	8
Cinclus cinclus (L.)	B.M.	3	—	6
Dipper	Ors.	1	—	—
Hirundo rustica L.	B.M.	4	—	—
Swallow	Ors.	5	1	—
Delichon urbica (L.)	B.M.	8	—	—
House-Martin	Ors.	3	—	—
Riparia riparia (L.) Sand-Martin	B.M.	1	—	—
Apus apus (L.)	B.M.	3	—	—
Swift	Ors.	1	—	—
Picus viridis L. Green Woodpecker	B.M.	1	—	—
Dryobates major (L.) Great Spotted Woodpecker	Ors.	1	—	—
Jynx torquilla L. Wryneck	B.M.	1	1	—
Athene noctua (Scop.)	B.M.	2	—	—
Little Owl	Ors.	3	—	—
Asio otus (L.)	B.M.	2	—	—
Long-eared Owl	Ors.	1	1	—
Strix aluco (L.)	B.M.	5	—	—
Tawny Owl	Ors.	1	—	—
Tyto alba (Scop.) Barn-Owl	B.M.	4	—	—
Accipiter nisus (L.)	B.M.	4	—	1
Sparrow-Hawk	Ors.	1	—	—
Anas platyrhyncha L.	B.M.	—	3	—
Mallard	Ors.	—	1	—
Anas acuta L.	B.M.	—	1	—
Pintail	Ors.	—	2	—
Spatula clypeata (L.) Shoveler	B.M.	—	1	—
Aythya fuligula (L.) Tufted Duck	B.M.	—	2	—
Somateria mollissima (L.)	B.M.	—	3	—
Common Eider	Ors.	—	1	—
Melanitta nigra (L.) Common Scoter	B.M.	—	1	—
Mergus serrator L. Red-breasted Merganser	B.M.	—	1	—
Phalacrocorax aristotelis (L.) Shag	B.M.	—	3	—
Hydrobates pelagicus (L.) Storm-Petrel	B.M.	1	—	—
Fulmarus glacialis (L.)	B.M.	1	—	1
Fulmar Petrel	Ors.	—	—	1
Columba palumbus L.	B.M.	1	—	—
Wood-Pigeon	Ors.	—	1	1
Columba oenas L.	B.M.	1	—	—
Stock-Dove	Ors.	3	—	—
Columba livia Gm.	B.M.	3	1	1
Rock-Dove	Ors.	4	—	1
Scolopax rusticola L. Woodcock	B.M.	—	—	1
Capella gallinago (L.)	B.M.	—	3	—
Snipe	Ors.	—	1	—
Calidris alpina (L.) Dunlin	B.M.	—	1	—
Tringa totanus (L.) Redshank	B.M.	—	1	—
Charadrius hiaticula L. Ringed Plover	B.M.	—	2	—
Vanellus vanellus (L.)	B.M.	—	4	1
Lapwing	Ors.	—	1	—
Sterna macrura Naumann Arctic Tern	B.M.	—	1	—
Larus ridibundus L. Black-headed Gull	B.M.	—	1	—
Larus canus L. Common Gull	B.M.	—	1	—
Larus fuscus L. Lesser Black-backed Gull	B.M.	—	2	—

TABLE 3—(*cont.*)

Host	Source of record	*C. gallinae*	*C. garei*	*D. g. gallinulae*
Larus marinus L.	Ors.	—	1	—
Great Black-backed Gull				
Rissa tridactyla (L.)	Ors.	1	—	—
Kittiwake				
Stercorarius parasiticus (L.)	B.M.	—	1	—
Arctic Skua				
Fratercula arctica (L.)	Ors.	1	1	1
Puffin				
Crex crex (L.)	B.M.	—	2	—
Corn-Crake				
Gallinula chloropus (L.)	B.M.	1	4	4
Moorhen	Ors.	—	1	2
Lagopus scoticus (Lath.)	B.M.	—	2	2
Red Grouse	Ors.	1	3	1
Phasianus colchicus L.	B.M.	2	5	3
Pheasant	Ors.	—	2	—
Perdix perdix (L.)	B.M.	—	4‡	—
Common Partridge	Ors.	—	2‡	—
Alectoris rufa (L.)	B.M.	—	1	—
Red-legged Partridge				
Gallus domesticus L.	B.M.	13	—	—
Fowl	Ors.	23	1	—

‡ This is an under-estimate since two of these six records were 'from several nests'.

in the nests of the Phasianidae and Tetraonidae (Game-birds), from which there are nineteen records as opposed to six of *D. g. gallinulae* and three of *C. gallinae.* It is also found more frequently in the nests of the Laridae than either of the other two species. In Britain it is the only flea recorded from the Linnet (*Carduelis spinus*) and the Bearded Tit (*Panurus biarmicus*), and despite the paucity of records it may be considered the dominant species in the nests of the Reed-Bunting (*Emberiza schoeniclus*). This list is sufficient to show *C. garei*'s predilection for ground-nesting species which favour damp sites and build open nests. Nevertheless, it has been collected from the nests of a great variety of birds, and Table 3 shows that it has been recorded more than once from the Starling (*Sturnus vulgaris*), Blackbird (*Turdus merula*), and Song-Thrush (*Turdus ericetorum*). There are some curious omissions from its list of hosts in Britain. One would expect a number of records from the Swan, the Herring-Gull, Dipper, Wren, and Robin, but *C. garei* has never been recorded from any of these birds in Britain, although there is one specimen in the C. Rothschild collection from *Troglodytes troglodytes* in Germany.

It appears that nests of the Wren (*Troglodytes troglodytes*) and Robin (*Erithacus rubecula*) present optimum conditions for *D. g. gallinulae.* Whatever these conditions may be—and the difference between the microclimate presented by a Robin's nest and a Linnet's nest appears superficially to be rather slight—they possibly prove unsuitable for *C. garei.* In these circumstances competition from *D. g. gallinulae* may prove too strong. On the other hand, host preference of the imago and not the requirements of the developmental stages may in part account for this distribution. It is less curious that there is only one record from the ground-bird *par excellence,* the domestic fowl, since it nests under exceptionally dry conditions.

As is pointed out in Table 4, *C. garei* occurs less frequently on the bodies of its hosts than either *C. gallinae* or *D. g. gallinulae.* Unfortunately the relevant data are often omitted both in the literature and on labels on slides, but certain entomologists such as James Waterston always noted whether specimens came from the body or nest of their host. In other cases collectors like W. H. Pollen and F. J. Cox can supply the necessary data. Generally speaking, if a flea is collected from the body of a bird the fact is considered of interest and is therefore noted, so most of the material without specific information on this point comes from nests. In the Charles Rothschild collection (Table 9) there is a batch of male and female *C. garei* which bears this label: 'Found by taxidermist in Natural History Museum, London. Land-Rail.' Although there is no mention of the body of the host, in this case I have assumed that these specimens were collected from the bird itself. Apart from this one batch of fleas, only specimens definitely known to have come from the host are counted in line 5 of Table 4. Since the totals in line 1 contain a number of records in which the relevant data are missing altogether, the figures for the number of fleas from the bodies of birds may be on the low side, but this should not affect the relative frequency of the three species concerned. Furthermore, there are a number of records in which no host is named at all: 'Found in old bird's nest', or 'From old nesting box' are all-too-familiar labels. Since these have been omitted as well as the records of 'free' specimens, there is probably adequate compensation for the odd flea which may have come from the body of its host and for which there are no available data. Altogether it seems likely that these figures, 9 per cent., 16 per cent., and 21 per cent., give a fair picture of the relative frequency of the three common bird-fleas on the bodies of their hosts.

TABLE 4

Comparative Records of C. gallinae, C. garei, *and* D. g. gallinulae *(compiled from all known British records)**

Species of flea	*C. gallinae*	*C. garei*	*D. g. gallinulae*
Total number of records	363	108	266
Number of known species of bird-hosts in Britain	65	49	59
Percentage on Passerine hosts	86	35	92
Number of records from body of host. (*Note*: Many of these records are of more than one specimen)	58 (16 per cent. of total records)	10 (9 per cent. of total records)	57 (21 per cent. of total records)
Proportion of sexes on body of host	60 ♀ 37 ♂	8 ♀ 2 ♂	33 ♀ 31 ♂
Proportion of sexes in nest (only collections in B.M. of under 20 specimens counted)	315 ♀ 188 ♂	77 ♀ 69 ♂	216 ♀ 126 ♂
Percentage of collections (from individual nests) in B.M. with over 20 specimens per nest†	31 per cent.	30 per cent.	13 per cent.

* These include unpublished records kindly supplied by various authors (see acknowledgements). Records away from a host, from mammalian hosts, or from unspecified birds' nests are omitted.

† In actual fact the percentage is probably much higher, since collectors often preserve a small fraction only of the specimens they find in a nest.

There are inadequate numbers (ten specimens only) for comparing the ratio of the sexes for this species. With this point in mind, fifty-six collections of *C. garei* (from the British Museum) from nests of named bird hosts were examined. Thirty-nine contained less than twenty specimens per nest, and the sex-ratio was 69 males to 77 females. The remaining seventeen collections contained more than twenty fleas per nest, and three collections out of these showed a great preponderance of females. One of the heavy infestations came from the nest of the Bearded Tit (*Panurus biarmicus*), and others were from Anatidae (four), *Perdix perdix* (three), and *Phalacrocorax aristotelis* (two).

In a previous paper (Rothschild, 1948) I described *C. garei* as a 'circumpolar species extending southwards to central Europe and through Alaska and Canada to the western United States'. It is well distributed on the mainland of Britain, but according to O'Mahony (1948) is relatively scarce in Ireland. This point is further discussed on page 212.

2. *Ceratophyllus gallinae* (Schrank) 1803. There are thirty-two separate records of this flea in the collection, but in actual numbers it exceeds *D. g. gallinulae*—fifty-two specimens compared with forty-four. *C. gallinae* has a sound claim to be the commonest bird-flea in Britain. It occurs on a greater variety of hosts, and the total number of records from birds in Britain (excluding the Fowl) about equals the combined collections of both *C. garei* and *D. g. gallinulae*. Moreover, a higher proportion of *C. gallinae* infestations may be described as heavy. It will be seen from Table 4 that 16 per cent. of the total records were from the body of the host, less than in the case of *D. g. gallinulae* but significantly more than in that of *C. garei*. It is also interesting that in this collection the number of female fleas on the host outnumbers the males by approximately 3:2, whereas they are about equal in the case of *D. g. gallinulae*. In eighty-one collections from named birds' nests (see Table 4) the sex-ratio was also approximately 3:2.

TABLE 5

Selected Hosts on which C. garei *is the Dominant Species of Flea*

Name of host	C. garei *records*	C. gallinae *records*	D. g. gallinulae *records*
Carduelis cannabina (L.) Linnet	3	0	0
Panurus biarmicus (L.) Bearded Tit	2	0	0
Anas platyrhyncha L. Mallard	4	0	0
Somateria mollissima (L.) Common Eider	4	0	0
Capella gallinago (L.) Snipe	4	0	0
Vanellus vanellus (L.) Lapwing	5	0	1
Perdix perdix (L.) Common Partridge (three of these records are from 'several nests')	6	0	0

In the 'Synopsis of the British Siphonaptera' (Rothschild, 1915) the hosts of *C. gallinae* are given as 'the fowl and many birds', and again 'in the nests of most birds and hen-houses'. In 1930 Wagner was more precise and lists: 'Birds, principally *Gallus, Passer, Parus*'. Freeman (1941) takes a wider view and considers that *C. gallinae* favours 'almost all birds'.

It is shown in Table 4 that (excluding collections from the Fowl) 86 per cent. of British records of *C. gallinae* are from Passerine birds. It does not occur on the Anatidae (two specimens recorded in the continental literature from ducks have not been checked and are probably errors in determination) or Scolopacidae and there is only one record each in Britain from the Rallidae and Laridae. The wild Jungle Fowl (*Gallus gallus* L.) is not infested with *C. gallinae*, and Jordan (1928) suggests that the domestic fowl is a secondary host and that the primary hosts in Europe may be the Paridae.

If we examine the list of records in Table 3 it will be noted that, despite the wide range of hosts, *C. gallinae* is much more common in the nests of birds which build in holes and some distance from the ground. These nests (as well as hen-houses) are almost certainly drier than those built in low situations. Thus *C. gallinae* is the dominant species in the nests of such birds as the Starling, House-Sparrow, Jackdaw, and Blue-Tit (see Tables 3, 6, and 9).

TABLE 6

Selected Hosts on which C. gallinae *is the Dominant Species of Flea*

Name of host	C. gallinae *records*	C. garei *records*	D. g. gallinulae *records*
Corvus corone L. Carrion-Crow	7	1	1
Sturnus vulgaris L. Starling	42	2	6
Passer domesticus (L.) House-Sparrow	46	0	3
Parus major L. Great Tit	25	0	9
Parus coeruleus L. Blue-Tit	36	0	4
Strix aluco L. Tawny Owl	6	0	0
Athene noctua (Scop.) Little Owl	5	0	0
Accipiter nisus (L.) Sparrow-Hawk	5	0	1

Out of the thirty-eight collections (from the British Museum) which contain more than twenty specimens per nest, eighteen came from *Parus* spp., six from *Passer domesticus*, and five from *Sturnus vulgaris*.

C. gallinae is widely distributed in Europe and in parts of Asia. There are specimens in the British Museum collection from France, Holland, Switzerland, Germany, Austria, Hungary, Roumania, Russia, north China, Mongolia, and east Turkestan. The species has probably been introduced into the United States and certainly into New Zealand, and has passed on to various species of indigenous hosts. Its range in the United States is restricted to the eastern States. It is found more frequently than other bird-fleas as a straggler on mammals. It is also recorded quite frequently away from any host (see Table 8), and has been noted by Waterston (1910) migrating from nests in impressive swarms. Bacot (1914) and Ioff (1946) have shown that this species can survive over a year in empty birdnests. Although it seems clear that *C. gallinae* may pass the winter on the body of its host and thus be transported back to the new nest when it is built, it is likely that birds can also be reinfested at their nesting-sites in the spring by fleas which have over-wintered under the bark of trees and in piles of rubbish, dead leaves, or old nesting-holes.

3. *Dasypsyllus gallinulae gallinulae* (Dale) 1878. Miss Clay and Colonel Meinertzhagen collected thirty-five records of this interesting species. It is shown in Table 4 that *D. g. gallinulae* occurs in a higher proportion on the bodies of birds than the other two common species, and also that 92 per cent. of its hosts are Passerines. These two facts are sufficient to account for its preponderance in the collection. It will be noted, for instance, that if all records of fleas from *Parus major* are pooled (Table 3), we find that *C. gallinae* exceeds *D. g. gallinulae* on this host by about 3:1, yet in this collection (Table 1) the reverse is true, and the ratio is 1:2.

The distribution of this species is one of considerable interest. The genus *Dasypsyllus* is essentially Neotropical, and *D. g. gallinulae* is the one representative in Britain of a characteristic South American genus. There are five species recorded from ground-nesting birds in Chile, Brazil, and the Argentine; one species in Sumatra on rats (probably an accidental host); and *D. stejnegeri* is known from Behring Isle and Commander Isle, Siberia, St. Paul Island (Pribilov Group), Alaska, and Langara Isle, Queen Charlotte's (British Columbia), and is probably parasitic on sea-birds, though the host is unknown (Jordan, 1929, and Holland, 1949). *D. g. gallinulae* is represented in Mexico, the U.S.A., and Canada by a subspecies, *D. g. perpinnatus* Baker, 1904. It is confined to the Pacific coast of the North American continent, although many of its bird hosts extend their range far eastwards. It is suggested by Holland (1949: 30) that 'this flea requires a type of nest (the exact genus or species of the bird host not being important) in country supporting a climate with a relatively high mean humidity, and perhaps certain temperature limits. As the nests of most Passerines are open and exposed directly to the atmosphere, it may be quite readily seen that it is possible for the humid atmosphere of the coast to present suitable breeding conditions for these fleas, whereas the dry climate and more extreme temperatures of the interior of British Columbia, even though the same birds were nesting, would prohibit development. Limitation of distribution of this type thus is almost undoubtedly controlled by factors which affect the flea larva rather than the adult.' This seems a sound hypothesis, and the distribution of *D. g. gallinulae* among bird hosts in Britain gives us a hint that it, too, may not be able to survive in dry nests.

C. gallinae is the dominant species in relatively dry nests which are built in holes or in the open but some distance from the ground, and *C. garei* is characteristic of ground-nesting species, especially those which favour damp sites, whereas *D. g. gallinulae* is found most commonly in the nests of Passerine birds building near the ground. The flea fauna of the Paridae in Britain present an excellent example of this fact, since *C. gallinae* is predominant in nests of the Blue-Tit (*Parus coeruleus*) and Great Tit (*Parus major*), *C. garei* in the nests of the Bearded Tit (*Panurus biarmicus*), and *D. g. gallinulae* in the nests of the Long-tailed Tit (*Aegithalos caudatus*). *D. g. gallinulae* is also dominant in nests of the Robin, Redstart, Willow-Warbler (*Phylloscopus trochilus*), and Greenfinch (*Chloris chloris*). There are no records at all of this flea from the Hirundinidae, Strigidae, Laridae, or Anatidae, and none, either, from the Fowl; however, it exceeds all others on the Sylviidae, with 23 records against 7 of *C. gallinae* and 2 of *C. garei*, and on the Turdidae with 85 records against 44 and 8 respectively.

Since we know nothing of the relative humidity of any nests, this suggestion must not be pushed too far. Moreover, the number of records from various hosts is too small to be significant. It is also obvious that the overlap between all these three species of fleas, particularly *C. gallinae* and *D. g. gallinulae*, is considerable (see Table 3), and there are several instances which run directly contrary to this theory. Thus there are more records of *D. g. gallinulae* than of *C. garei* in the nests of both the Moorhen and Dipper. There is an equal number of records of *C. gallinae* and *D. g. gallinulae* from the Mistle-Thrush (*Turdus viscivorus*), although the former has a 10:9 majority over *D. g. gallinulae* in nests of the Song-Thrush (*Turdus ericetorum*). Despite these and numerous other contradictions, the data contained in Table 3, meagre though they are, suggest that all these three common species of bird-flea, not only *C. garei*, have a preference for birds favouring certain types of nesting sites.

TABLE 7

Selected Hosts on which D. g. gallinulae *is the Dominant Species of Flea*

Name of host	D. g. gallinulae *records*	C. gallinae *records*	C. garei *records*
Chloris chloris (L.) . . . Greenfinch	9	2	0
Fringilla coelebs L. . . . Chaffinch	10	5	1
Phylloscopus trochilus (L.) . Willow-Warbler	8	0	0
Sylvia communis Lath. . . Whitethroat	5	1	0
Turdus merula L. . . . Blackbird	27	22	4
Erithacus rubecula (L.) . . Robin	33	4	0
Troglodytes troglodytes (L.) . Wren	16	12	0
Gallinula chloropus (L.) . . Moorhen	6	1	5

D. g. gallinulae is not found in such large numbers in the nests of birds as either *C. gallinae* or *C. garei* (see Table 4). Out of ninety-three batches from the nests of named bird hosts in the British Museum collection, only 13 per cent. contained more than ten specimens of either sex. The hosts which are most heavily infested numerically are the Warblers and the Robin, which are also the hosts with the relatively largest number of records. One heavy infestation came from the nest of the Moorhen, proving that this species can breed successfully in what appear to be especially damp nests.

The numbers of the sexes of *D. g. gallinulae* on the body of the host is almost equal (see Table 4), but in the nest there is a heavy preponderance of females—216:126 in the eighty batches counted.

The range of *D. g. gallinulae* on the continent of Europe is not known with any accuracy. In the British Museum collection there are specimens from France, Holland, Germany, Switzerland, Portugal, Italy, Roumania, Iceland, the Azores, Madeira, and a pair from the Nepal-Sikkim frontier of northern India.

TABLE 8

British Records of C. gallinae, C. garei, *and* D. g. gallinulae *collected away from any Host or Nest*

Species of flea	*Location*	*Locality*	*Date*	*Collector*	*Collection*
C. gallinae (3 ♂, 3 ♀)	Refuse dump	N. Ireland	1939	Received from Dept. of Agriculture	Rothschild Coll. (B.M.)
C. gallinae (1 ♀)	Dead leaves in orchard	Kennetpans, Kincardine on Forth	1914	British Museum	,,
C. gallinae (1 ♀)*	Beneath beech bark	Hylton Bridge, Sunderland	7.xi.05	R. S. Bagnall	,,
C. gallinae (1 ♀)	In rotten oak-tree	Sherwood	30.v.27	C. E. Stott	,,
C. gallinae (1 ♂, 3 ♀)	In hollow tree	Wroxeter, Uppington, Shropshire	23.viii.12	G. A. K. Marshall	,,
C. gallinae (many)	Found in a garden	Newport, Shropshire	x.49	J. Maclagan	,,
C. gallinae (1 ♂, 1 ♀)	From keeper's larder	Leicester	3.iv.1899	H. B. Headley	,,
C. gallinae (many)	On palings	Leicester	17.iv.1899	H. B. Headley	,,
C. gallinae (1 ♂)	In moss	Oxford	6.iii.1897	J. Shipp	,,
C. gallinae	Warehouse	Manchester	1930	H. R. P. Collett	H. Britten
C. gallinae (many)	Under bark of beech-trees	Hylton, Co. Durham	v.09	R. S. Bagnall	One specimen Rothschild Coll. (B.M.)
C. gallinae (2 ♂, 3 ♀)	Cruciferous plant	Gibside, Co. Durham	v.09	R. S. Bagnall	Bagnall Coll.
C. gallinae (1 ♀)	Stump of *Sorbus aucuparia*	Drum, Aberdeenshire	15.v.42	G. D. Morison	Morison Coll.
C. gallinae (1 ♀)	Dead leaves in glasshouse	Brodie, Nairn, Morayshire	20.ii.45	,,	,,

---

* Although there is only one specimen in the Rothschild Collection, Bagnall (1921) records it 'in numbers under beech tree bark' (Bagnall, R. S., *Trans. Nat. Hist. Soc. Northumberland & Durham*, 1921, 5: 181–198).

TABLE 8—(*cont.*)

Species of flea	*Location*	*Locality*	*Date*	*Collector*	*Collection*
C. gallinae (in numbers)	In barns	Holton, Suffolk	1913	Strickland and Merriman	†
C. gallinae	Hole in an oak-tree	Holton, Suffolk	1913	Strickland and Merriman	
C. gallinae (1 ♀)	From *Vespa vulgaris*	Harpenden, Herts.	17.iii.21	R. Stenton (Min. of Agr.)	British Museum
C. garei (1 ♂)	Sandhills	Hynish, I. of Tiree, Argyllshire	30.iv.12	H. Donisthorpe	Rothschild Coll. (B.M.)
C. garei (1 ♀)	In a stack of reeds	Funton, nr. Iwade, Kent	19.iii.98	J. J. Walker	„
C. garei (1 ♂, 2 ♀)	Haystack refuse	Hunstanworth, Co. Durham	?	R. S. Bagnall	Bagnall Coll.
D. g. gallinulae (2 ♀)	In a cave on sea cliffs	Donegal, Ireland	vii.22	E. E. Austen	Rothschild Coll. (B.M.)
D. g. gallinulae (3 ♀)	Among stones in cave in sea cliffs	Near Portsalon, Lough Swilly, Co. Donegal	8.viii.22	G. C. C. Damant	„
D. g. gallinulae (3 ♂, 5 ♀)	Read's Cavern	Burrington Coombe, Mendip Hills, N. Som.	4.v.40	G. A. Walton	„
D. g. gallinulae	In grass	Rainow, Cheshire	7.vi.19	F. Neave	H. Britten
D. g. gallinulae	Swept off *Vaccinium*	Long Hill, Co. Wicklow	21.v.23	A. W. Stelfox	Nat. Mus., Dublin
D. g. gallinulae (1 ♀)	Dry bark of cherry-tree	Craibstone, Aberdeen	5.iv.43	G. D. Morison	Morison Coll.
D. g. gallinulae (1 ♀)	Herbage	Craibstone, Aberdeen	1.v.41	„	„
D. g. gallinulae (1 ♀)	Pine log	Drum, Aberdeen	15.v.42	„	„
D. g. gallinulae (1 ♀)	Among herbage	Newtonhill, Kincardine	21.v.49	„	„

† These records were published in *Parasitology*, 1913, **6** (1): 1–19 (Observations on British rat-fleas, by G. H. F. Nuttall, C. Strickland, and G. Merriman), but the whereabouts of the specimens is not known.

D. STRAGGLERS FROM MAMMALIAN HOSTS

1. *Nosopsyllus fasciatus* (Bosc. D'Antic) 1801. One specimen was collected from *Troglodytes t. troglodytes* in Arran. The normal host is the Brown Rat (*Rattus norvegicus*). There are three females and one male of this species in the British Museum collection from a Blackbird's nest in Holland (Smit, 1949).

2. *Orchopeas wickhami* (Baker) 1895. One specimen of the Grey Squirrel flea, which was originally imported into this country from the U.S.A. with its host, *Sciurus carolinensis*, was collected from *Parus major newtoni* Prazak. This species of flea is a more frequent straggler on to avian hosts. In the Charles Rothschild collection there are specimens collected from 'a Magpie's and Hawk's nest', and an unnamed bird's nest in the New Forest, Hampshire. An exchange of fleas between birds and squirrels is, in fact, a usual accident, and *Monopsyllus sciurorum* (Schrank) 1803 has been known to breed in large swarms in an Owl's nest (Waterston, 1910),

while *C. gallinae* has frequently been recorded breeding in Squirrels' dreys in Britain, although not in large numbers (Freeman, 1941).

SOME GENERAL CONSIDERATIONS RELATING TO *C. GALLINAE*, *C. GAREI*, AND *D. G. GALLINULAE*

Geographical distribution. With regard to the three common species of bird-fleas *C. gallinae*, *C. garei*, and *D. g. gallinulae* in Britain, the maps in Figs. 1–3 all tell much the same story. These fleas are widely distributed throughout the British Isles and certain obvious concentrations mark the home territories of well-known collectors such as C. Rothschild, H. G. Jeffrey, R. Newstead, H. Britten, and J. Waterston. In Ireland, according to E. O'Mahony, *C. garei* is relatively scarce, but unless lists of negative records are provided such statements may be somewhat misleading. If a long series of Ducks' nests, or Snipes' nests, yielded no specimens of *C. garei* this would be significant. In Cornwall, Turk (1946) considered *C. gallinae* 'not so common as it seems to be in other counties. Its place seems to be taken by *D. gallinulae*, which is a very common species. . . . I have records from many small Passerine birds and from Blackbirds, the domestic pigeon and the Wood-Pigeon.' However, if we pool all records for the British Isles (see Table 3), *D. g. gallinulae* is seen to be the dominant species in the nests of the Blackbird (G. B. Thompson, 1937, records 350 specimens from one nest), and the same may apply to the unnamed 'small Passerines' to which Turk refers earlier. Since going to press Dr. Turk has sent me a list of these species. They include the Robin, Wren, and Tree-Creeper, in which *D. g. gallinulae* is usually dominant; the Thrush, Mistle-Thrush, and Goldcrest, in which nests both species have been recorded an approximately equal number of times; and the Great Tit, Blue-Tit, Jackdaw, Carrion-Crow, Raven, and Rook, in which nests *C. gallinae* is usually the dominant species of flea. In all, Dr. Turk found *D. g. gallinulae* 'in nearly a hundred nests'. In Ireland O'Mahony (1939) has come to a somewhat similar conclusion with regard to these two species, namely that *D. g. gallinulae* is 'the commoner of the two in point of numbers', but again the seven species of birds' nests he has listed in which *D. g. gallinulae* outnumber *C. gallinae* include the Wren, the Greenfinch, the Chaffinch, the Mistle-Thrush, the Song-Thrush, and the Blackbird. *D. g. gallinulae* is usually dominant in five of these, and in the nest of the Song-Thrush the two species are about equally represented (see Tables 3 and 6). He did not record *D. g. gallinulae* at all from nests of the House-Sparrow or the Blue-Tit—records which would have been far more significant. It would be of much interest if further collecting in the west of England and Ireland confirmed the suggestions made by O'Mahony and Turk, since the distribution of *D. g. gallinulae* among its hosts in Britain and the distribution of the subspecies *D. g. perpinnatus* in North America suggest that it requires rather a high mean humidity in the nest. Thus it might possibly increase the range of its Passerine hosts where the mean annual rainfall is greater, and also occur in larger numbers in the nests of certain species where it is numerically sparse in drier conditions. In the meantime, however, the distribution maps of *C. gallinae*, *C. garei*, and *D. g. gallinulae* (Figs. 1, 2, and 3) show the distribution of the collectors rather than that of the fleas, and indicate that all three species occur where they are looked for.

A few observations on the distribution of *C. vagabunda* and the Martin fleas are included in the description of the collection on pages 195 and 196. With all the species concerned further collecting is necessary before any conclusions can be drawn. From the little we know, however, it is obvious that the flea fauna of Scotland is of considerable interest. There are several species, such as *C. borealis*, *Orneacus waterstoni*, and *Frontopsylla laetus*, which display a so-called alpine-boreal type of distribution, occurring in Scotland and the Swiss Alps and in some cases along the northern fringe of Europe, but not apparently in England or the intervening areas of the Continent. This type of distribution is even more striking in the case of fleas than in other insects, since the host itself is widely distributed. On the other hand, *C. hirundinis* occurs on the House-Martin throughout its range. It is, however, clear, as we have seen in the case of *D. g. perpinnatus*, that other factors limit the distribution of the fleas, presumably requirements of the developmental stages. Although many of the Passerine hosts of bird-fleas migrate to South Africa and other warm countries in the winter, and (we may surmise) take their fleas with them, the Ceratophyllid bird-fleas have remained a group which is characteristic of temperate climates.

In east Africa over a period of fourteen years, G. H. E. Hopkins and a team of his friends examined over 2,000 birds shot for food or scientific purposes. Ectoparasites were collected by the method described in the introduction. Not a single specimen of *Ceratophyllus* was found, thus confirming the fact that the apparent absence of this genus on birds, in tropical Africa at least, is genuine. It should be noted that a number of migrants were included in this collection. Thus fifteen specimens of the Sand-Martin (*Riparia riparia*) and six specimens of the Swallow (*Hirundo rustica*) were among the negative records. There were also smaller numbers of birds such as the European Cuckoo (*Cuculus c. canorus*), the Whinchat (*Saxicola rubetra*), the Green Sandpiper (*Tringa ochropus*), and the Wood Sandpiper (*Tringa glareola*).

Host-preference. Among the three species of common bird-fleas which are not host-specific we can discern two different trends of host-preference. On the one hand there is a marked predilection on the part of *D. g. gallinulae* and *C. gallinae* for the Order Passeriformes, and on the part of *C. garei* for the Charadriiformes, Anseriformes, and Galliformes. Within this framework we can—despite a big overlap and many exceptions—discern a preference for different types of nesting sites. Broadly speaking, *C. garei* favours damp nests on the ground, *D. g. gallinulae* those built near the ground, and *C. gallinae* nests built in drier situations some distance from the ground. There is also one generalization which may be made regarding the host relationship of all these three common species: those birds which are the most *frequently* infested and may be termed the favoured hosts are also the most *heavily* infested. Thus *C. gallinae*, which can breed in such a wide variety of nests, is found regularly in greatest numbers and obviously 'does best' in the nests of *Passer domesticus*, *Sturnus vulgaris*, *Parus*, and certain Strigidae. This fact is reflected in the number of specimens of *C. gallinae* collected from individual birds by

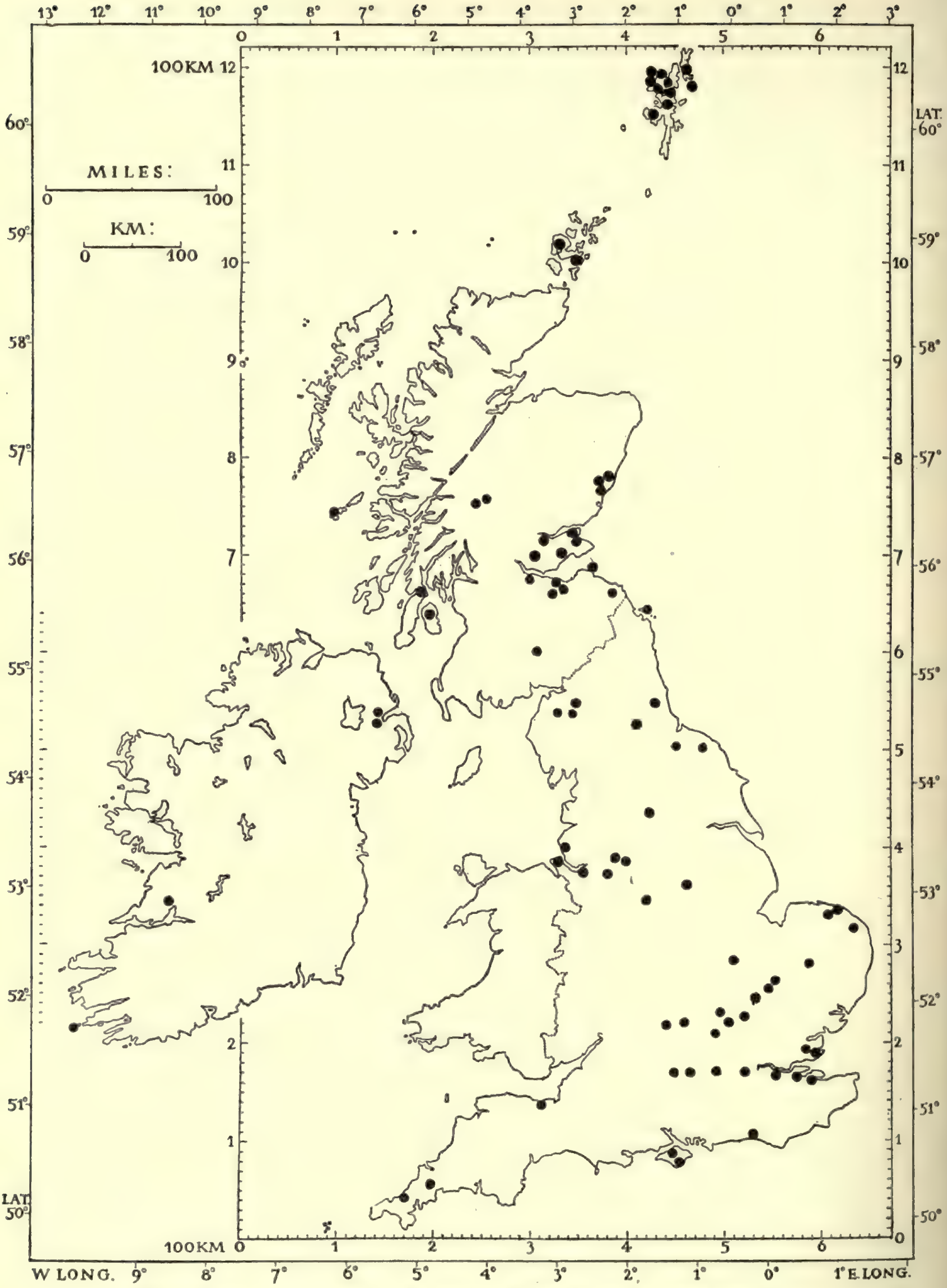

13° 12° 11° 10° 9° 8° 7° 6° 5° 4° 3° 2° 1° 0° 1° 2° 3°
0 1 2 3 4 5 6
100KM 12
MILES:
0 100
KM:
0 100
LAT.
60°
59°
58°
57°
56°
55°
54°
53°
52°
51°
50°
11
10
9
8
7
6
5
4
3
2
1
0
100KM 0
W LONG. 9° 8° 7° 6° 5° 4° 3° 2° 1° 0° 1° E.LONG.

FIG. 1. Distribution map of *C. garei* in Britain, based on 108 records.

In the case of multiple records from one locality, for example twenty-three separate records of *C. gallinae* from Blue-Tits' nests in Cambridge, only one circle is used. This accounts for the fact that there are more records than circles on each map. Massed records of this type merely indicate intensive collecting in the area concerned, and have no bearing on the question of distribution.

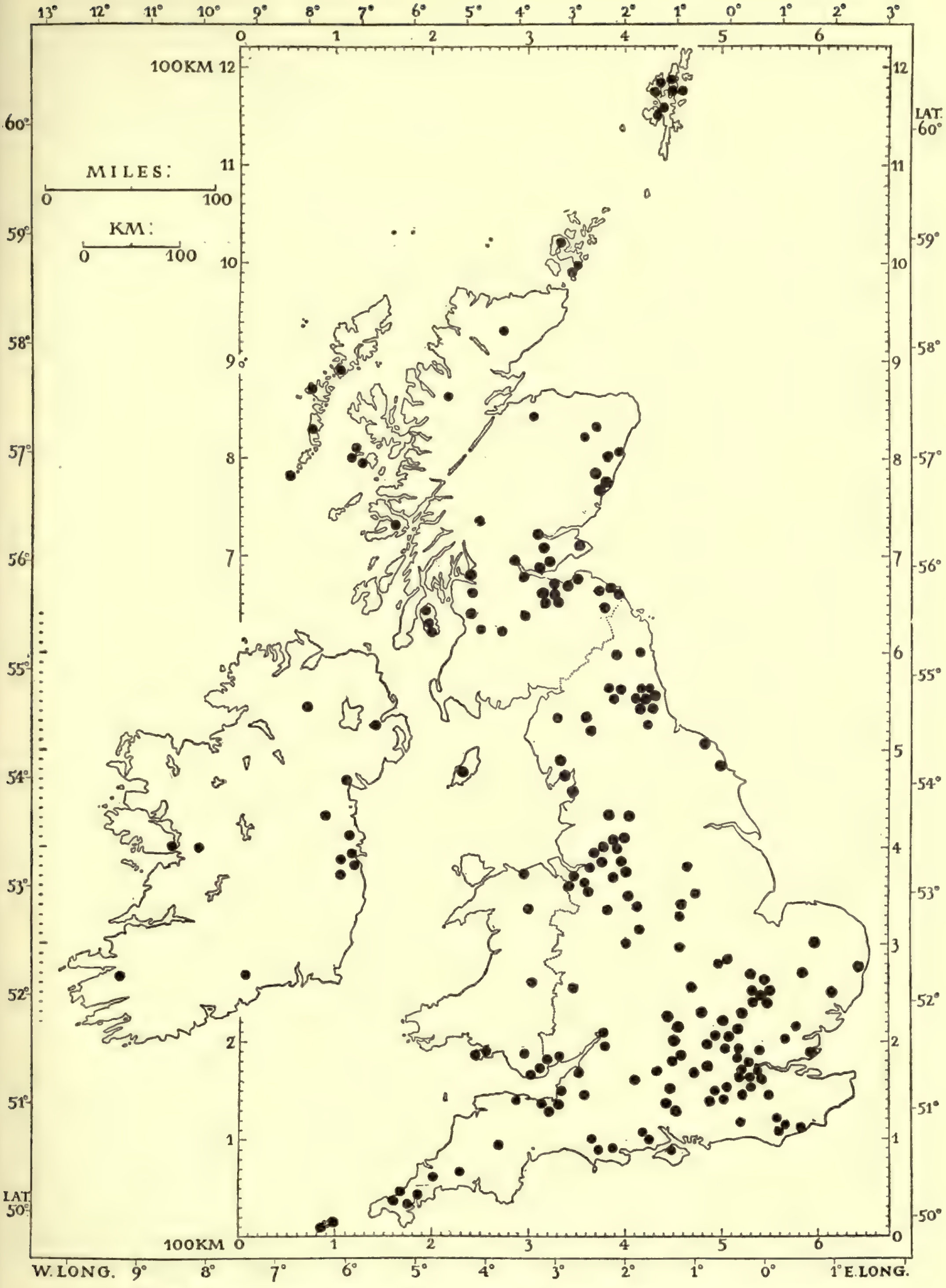
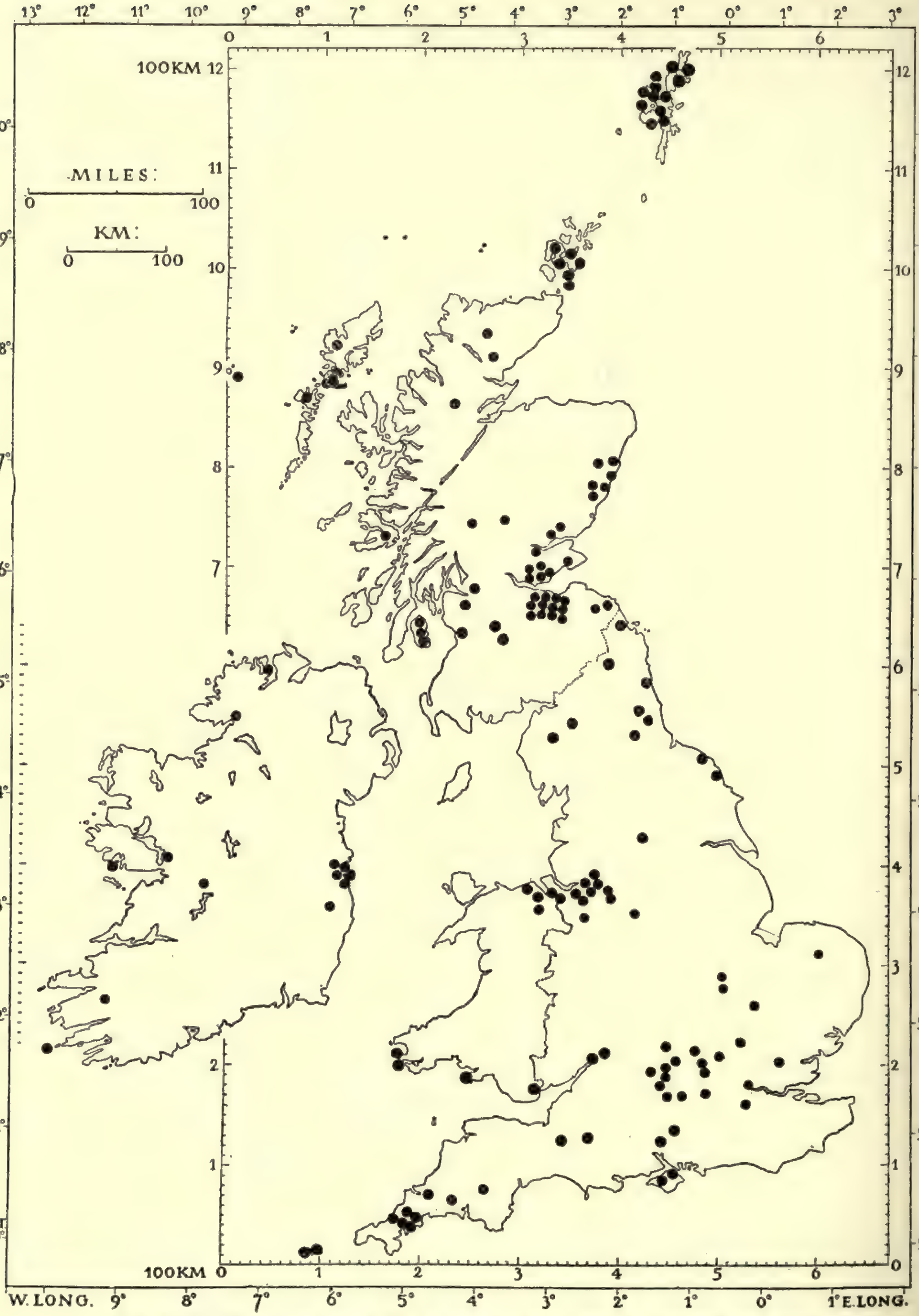

13° 12° 11° 10° 9° 8° 7° 6° 5° 4° 3° 2° 1° 0° 1° 2° 3°
0 1 2 3 4 5 6
100KM 12
11
10
9
8
7
6
5
4
3
2
1
100KM 0
LAT. 60°
59°
58°
57°
56°
55°
54°
53°
52°
51°
LAT. 50°
MILES:
0
100
KM:
0
100
W. LONG. 9° 8° 7° 6° 5° 4° 3° 2° 1° 0° 1° E. LONG.

FIG. 2. Distribution map of *C. gallinae* in Britain, based on 363 records.



MILES
0
100
KM
0
100
100KM
LAT.
W. LONG.
E. LONG.

FIG. 3. Distribution map of *D. g. gallinulae* in Britain, based on 266 records.

Meinertzhagen and Pollen, thus six, four, and four specimens from Starlings, four, three, and two specimens from *Parus* spp., and nine and six specimens respectively from individual Little Owls (Tables 1 and 9).

Bacot (1914) has pointed out that in some cases egg-production of *Nosopsyllus fasciatus* falls off in drought, and Buxton (1938) has shown that in the case of *X. cheopis* 'even at one temperature and within tolerable limits of humidity the production of the first filial generation of fleas is closely dependent on humidity, the production being less as the fatal limit is approached'. Edney (1947) has shown that the life of the adult *X. brasiliensis* is shortened if the pupal stage is kept at low humidities, and these types of phenomena may account for the fact that all three common bird-fleas occur in smaller numbers in some nests than in others, only the favoured hosts providing the optimum conditions. It is of course possible that we are concerned with a combination of many factors, and not only the humidity requirements of the developmental stages. However, in this fact we can see indications of incipient or vestigial host-specificity—either a legacy from the past or a hint of things to come.

There are also indications of a third type of host-preference (such as we find in *C. vagabunda*) which at times seems to cut across the two main trends already mentioned. Undoubtedly certain birds appear to be more attractive or susceptible than others to one or all of the species concerned. Thus the Shag (*Phalacrocorax aristotelis*) and Cormorant (*Phalacrocorax carbo*) are placed in the same genus, and build the same type of nest in the same type of habitat, frequently in colonies which adjoin. There are three records of *C. garei* from the former (including one very heavy infestation where over 500 fleas were counted) and none at all from the latter. There are also more than six records from the Partridge (*Perdix perdix*)—a bird which is not infested with any other flea (Table 5). However, both *C. gallinae* and *D. g. gallinulae* as well as *C. garei* have been collected from the Pheasant (*Phasianus colchicus*) and Red Grouse (*Lagopus scoticus*). Here again there would appear to be little if any difference between these three nests, which are no more than sheltered scrapes lined with grass; in fact Pheasants and Partridges not infrequently lay in the same nest. It is also curious that *D. g. gallinulae* should have a marked predilection for the Moorhen (six records), since this bird is not a Passerine and (more important still) favours unusually damp nesting-sites.

The records from the Wood-Pigeon (*Columba palumbus*) suggest that this may also be a case in which the bird itself is attractive to fleas, since the type of nest it builds is exceptionally unsuitable for nidicoles. In Finland Nordberg (1936) has examined the nests of over fifty species of birds. He has shown that nests built in holes and what he terms 'half-holes' (*halbhölen Nester*) support the heaviest populations of nidicoles generally, and also the greatest variety of species. The Stock-Dove (*Columba oenas*) is one of the most heavily infested of all, with a total of fifty-eight species of nidicoles and 6,573 specimens per 1 dm.^{3} of nesting material. The Wood-Pigeon, with one species and only twenty specimens per 1 dm.^{3}, is unquestionably the least infested out of all those he examined in Finland. In Britain there are only four records of *C. gallinae* from the Stock-Dove, but from the Wood-Pigeon we have records of the following species: *C. gallinae* (1—but 6 females

TABLE 9

C. gallinae, C. garei, *and* D. g. gallinulae *in the British Museum* (*Natural History*) *from named Bird Hosts*

CORVIDAE

Corvus corone L. (*Carrion-Crow)

C. gallinae, 2 ♀, N. Wales, vii.30[†] (N. H. Joy), nest; 7 ♂, 11 ♀, Ashton, Oundle, 1919 (N. C. Rothschild), nest[‡]; Ashton, Oundle, summer, 1919 (J. Stuart), nest; 3 ♀, Ashton Wold, Oundle, vi.26 (F. J. Cox), nest; < ♂, < ♀, Layer Marney, Essex, v.36 (M. Rothschild), nest; Layer Marney, Essex, ix.36 (M.R.), nest; 1 ♀, Reading, vii.31 (N. H. Joy), nest; all Rothschild Coll.

Corvus monedula L. (Jackdaw)

C. gallinae, 4 ♂, 2 ♀, Colinton, Midlothian, 24.v.06 (J. Waterston), nest, B.M. 1914.517; < ♂, < ♀, Tring, Herts., summer, 1919 (N.C.R.), nest; Tring, Herts., viii.26 (K. Jordan), nest; 1 ♀, Bushey Park, 2.iv.06 (A. H. Bishop); 3 ♂, 2 ♀, Windsor Park, 22.xi.28 (H. Donisthorpe), nest; 1 ♂, 7 ♀, Norfolk, 24.iv.34 (W. H. Pollen), nest; 3 ♂, Ross-shire, 20.iii.34 (W. H. Pollen), body; 1 ♂, 1 ♀, Northampton, 1.v.35 (W. H. Pollen), body; *D. gallinulae*, 5 ♂, 4 ♀, Duncarn Hill, Fifeshire, 6.xi.09 (H. Ashworth), nest; all Rothschild Coll.

Pica pica (L.) (Magpie)

C. gallinae, 2 ♀, New Forest, 5.v.98 (B. G. Rye), nest, B.M. 98.88; 1 ♀, Essex, 16.i.35 (W. H. Pollen), body, Rothschild Coll.

STURNIDAE

Sturnus vulgaris L. (Starling)

C. gallinae, 3 ♂, 2 ♀, Little Roe Island, vii.10 (J. Waterston), nest; < ♂, < ♀, Ollaberry, vi.10 (J. Waterston), nest; Ollaberry, 16.iii.12 (J. Waterston), nest; Ollaberry, vi.12 (J. Waterston), nest; all B.M. 1914.517; 1 ♂, Aberdour, Fifeshire, 20.iv.07 (J. Waterston), nest; Rothschild Coll.; 5 ♀, Woodburn House, near Dalkeith, 12.v.08 (J. Waterston (?)), nest; B.M. 1914.517; 1 ♂, Wiltshire, 14.iv.34 (W. H. Pollen), body; Rothschild Coll.; 2 ♂, 2 ♀, Northampton, 1.xii.34 (W. H. Pollen), body; Rothschild Coll.; 1 ♂, 10 ♀, Colinton, Midlothian, 19.v.09 (J. Waterston), nest; 10 ♂, < ♀, Arniston, Midlothian, 28.v.09 (A. Bennett), nest; 8 ♂, < ♀, Loudoun, Ayrshire, 17.vi.09 (J. Gloag), nest; all B.M. 1914.517; 7 ♂, 8 ♀, Armitage, Staffs., 24.iii.28 (C. E. Stott), nest; 2 ♂, 2 ♀, Ince, Cheshire, 1890 (R. Newstead); < ♂, < ♀, Ashton, Oundle, 5.vi.06 (F. J. Cox); Ashton, Oundle, 11.v.09 (F. J. Cox); Ashton, Oundle, v.10 (F. J. Cox), nest; Ashton, Oundle, vii.26 (F. J. Cox), nest; Ashton, Oundle, v.27 (F. J. Cox), nest; 2 ♀, Boxmoor, Herts. (A. Piffard); < ♂, < ♀, Tring, 7.vii.1900 (N.C.R.), nest; Tring, vi.01 (N.C.R.), nest; Tring, 10.vii.01 (N.C.R.), nest; 1 ♂, 6 ♀, Netherfield, Sussex, 1.vii.07 (W. R. Butterfield); 8 ♂, 6 ♀, Hastings, Sussex, 1909 (W. R. Butterfield); 3 ♂, 1 ♀, Reading, Berks., 9.vi.39 (B. T. Parsons), nest; 1 ♂, Brockenhurst, Hants., 28.v.06 (B. Piffard); < ♂, < ♀, Newport, I.O.W., v.10 (H. G. Jeffrey), nest; Newport, I.O.W., 1912 (H. G. Jeffrey), nest; *C. garei*, 1 ♂, Hockley, Essex, 25.v.03 (F. W. Frohawk); *D. gallinulae*, 1 ♂, 12 ♀, Kirkwall, Orkney, 10.v.06 (J. Waterston), nest; all Rothschild Coll.; Kirkwall, Orkney, 8.vi.06 (J. Waterston), nest; 1 ♀, Lochgelly, 25.vi.09 (J. Brown); 3 ♂, 5 ♀, Arniston, Midlothian, 28.v.09 (A. Bennett), nest; all B.M. 1914.517.

FRINGILLIDAE

Coccothraustes coccothraustes (L.) (Hawfinch)

D. gallinulae, 1 ♂, 1 ♀, Eaton, nr. Chester, 5.v.01 (R. Newstead), nest; Eaton, nr. Chester, 9.v.01 (R. Newstead), nest; all Rothschild Coll.

---

[*] Name of host as in Witherby and not necessarily as on slides. Thus *Turdus musicus* becomes *Turdus ericetorum* since Waterston's publications make it clear that the Song-Thrush is the host from which he obtained the specimens in question. Certain specimens from *Corvus corone* are merely marked 'Carrion-Crow'.

[†] With regard to material in the British Museum, the registered number is appended in all cases unless the material referred to pertains to the Rothschild Collection (1923. 615). It must be explained that after Charles Rothschild's death in 1923 material continued to flow in to Karl Jordan, which he worked out and then incorporated in the Rothschild Collection. Although technically British Museum material, the author has made no attempt to separate it from the rest, since she feels that the date is sufficient indication of the fact that it was incorporated after the Rothschild Collection passed into the absolute control of the Trustees.

[‡] When it is known for certain if specimens were collected from the body or nest of the host this information is added—whether or not it is present on the slides or tubes.

TABLE 9—(*cont.*)

Chloris chloris (L.) (Greenfinch)

C. gallinae, 1 ♂, 1 ♀, Colinton, Midlothian, 11.v.06 (J. Waterston), nest; *D. gallinulae*, 1 ♀, Lothianburn, 26.v.06 (?); 1 ♂, 1♀, Arniston, Midlothian, 28.v.09 (A. Bennett), nest; Arniston, Midlothian, 8.vi.09 (A. Bennett), nest; all B.M. 1914.517; 2 ♀, Abbey St. Bathans, Berwickshire, 14.v.07 (J. Waterston), nest; 3 ♀, Tresco, Isles of Scilly, 12.vi.07 (F. J. Cox), nest; all Rothschild Coll.

Carduelis carduelis (L.) (Goldfinch)

C. gallinae, < ♂, < ♀, Redland, Bristol, 1917 (P. Stonelake); *C. garei*, 2 ♂, 2 ♀, Fancott, nr. Luton, i.44 (R. B. Laurence), nest; all Rothschild Coll. (B.M.).

Carduelis cannabina (L.) (Linnet)

C. garei, < ♂, < ♀, Newport, I.O.W., vi.10 (H. G. Jeffrey), nest; Rothschild Coll. (B.M.).

Fringilla coelebs L. (Chaffinch)

C. gallinae, 1 ♂, Ross-shire, 16.iii.34 (W. H. Pollen), body; Rothschild Coll.; 2 ♀, Arniston, Midlothian, vi.09 (A. Bennett), nest; 3 ♀, Loudoun, Ayrshire, summer, 1909 (? collector); *D. gallinulae*, 8 ♂, 10 ♀, Inchture, Perthshire, vii.06 (J. H. McNair), nest; Inchture, Perthshire, viii.06 (J. H. McNair), nest; 1 ♂, Lahill, Largo, 29.x.12 (L. J. Rintoul, E. V. Baxter), body; all B.M. 1914.517; 8 ♂, 3 ♀, Lesmahagow, Lanarkshire, 31.vi.06 (J. Clark, per Watkins and Doncaster), nest; Rothschild Coll.; 2 ♂, 9 ♀, Loudoun, Ayrshire, vi.09 (J. Gloag), nest; B.M. 1914.517.

Emberiza citrinella L. (Yellow Hammer)

C. gallinae, 1 ♀, Nethercraigs, nr. Paisley, 4.v.09 (J. Waterston), nest; B.M. 1914.517; < ♀, Tring, Herts., 19.vii.04 (N.C.R.), nest; Rothschild Coll. (B.M.); *D. gallinulae*, 1 ♂, 3 ♀, Rilla Mill, Cornwall, vi.05 (K. Jordan), nest; Rothschild Coll. (B.M.).

Emberiza calandra L. (Corn Bunting)

C. garei, 1 ♀, Todhead, Kinneff, Kincardineshire, 16.vi.09 (J. Waterston), body; B.M. 1914.517.

Emberiza schoeniclus (L.) (Reed Bunting)

C. garei, 6 ♂, 3 ♀, Tring, Herts., vii.03 (N.C.R.), nest; Tring, Herts., vi.06 (F. J. Cox), nest; *D. gallinulae*, 1 ♀, Windsor Forest, Surrey, 23.vi.28 (F. W. Frohawk); all Rothschild Coll.

PLOCEIDAE

Passer domesticus (L.) (House-Sparrow)

C. gallinae, 3 ♂, 5 ♀, Carie, Rannoch, 24.vii.08 (F. J. Cox), nest; Rothschild Coll. (B.M.); < ♂, < ♀, Mull, Argyllshire, 28.viii.12 (L. G. Esson); Rothschild Coll. (B.M.); 8 ♂, 9 ♀, Wilberlea, St. Andrews, Fife, 18.viii.08 (J. Waterston), nest; 3 ♀, Auchinblae, Kincardineshire, 27.v.09 (J. Campbell); 4 ♂, 10 ♀, Kennetpans, Clackmannan, 8–10.viii.08 (J. Waterston), nest; 1 ♂, Gorebridge, nr. Dalkeith, 17.vii.06 (J. Waterston), nest; 8 ♂, < ♀, Colinton, Midlothian, 7.v.06 (J. Waterston), nest; Colinton, Midlothian, 11.v.06 (J. Waterston), nest; 2 ♂, 6 ♀, Dunlaverock, Coldingham, viii.09 (J. F. Cormack); Dunlaverock, Coldingham, 7.ix.09 (J. F. Cormack); Dunlaverock, Coldingham, ix.09 (J. F. Cormack); 1 ♂, 1 ♀, Dunlaverock, Coldingham, 2.viii.10 (J. F. Cormack), nest; < ♂, < ♀, Coldingham, Berwickshire, 25.ix.08 (J. F. Cormack), nest; Coldingham, Berwickshire, viii.09 (J. F. Cormack), nest; all B.M. 1914.517; 1 ♀, Armitage, Staffordshire, x.31 (L. C. E. Stott); 4 ♂, 1 ♀, Penarth, Glamorgan, 20.ix.28 (H. M. Hallett); 2 ♂, 3 ♀, Whipsnade, Bedfordshire, nest; < ♂, < ♀, Tring, Herts., 1901 (N.C.R.), nest; Tring, Herts., vi.06 (K. Jordan), nest; Tring, Herts., ix.10 (K. Jordan), nest; < ♂, < ♀, London, xi.09 (N.C.R.), nest; all Rothschild Coll.; 2 ♂, 5 ♀, Woking, Surrey; B.M. 1910.266; 2 ♀, Pylewell Park, Lymington, Hants, 1906 (R. Newstead); < ♂, < ♀, Newport, I.O.W., v.10 (H. G. Jeffrey), nest; Newport, I.O.W., 1912 (H. G. Jeffrey), nest; all Rothschild Coll.; *D. gallinulae*, 1 ♂, Arniston, Midlothian, 28.v.09 (A. Bennett); B.M. 1914.517; 4 ♂, 2 ♀, Longwood, Southwick, Sunderland, 25.vi.10 (F. Palin); 3 ♂, 2 ♀, Park Mill, Gower Peninsula, Glamorgan, 23.v.19 (F. J. Cox), nest; all Rothschild Coll.

ALAUDIDAE

Alauda arvensis L. (Skylark)

C. gallinae, 1 ♂, Burwick, Orkney, 11.vi.06 (J. Waterston), nest; Rothschild Coll. (B.M.); 1 ♀, Aberlady, 13.vi.06 (R. Cochrane), nest; B.M. 1914.517; *C. garei*, 11 ♂, 3 ♀, Wallasey sandhills, Liverpool, 18.vi.06 (Watkins and Doncaster); Rothschild Coll.; *D. gallinulae*, 1 ♀, Ollaberry, 8.vii.12 (J. Waterston), body; 1 ♀, East of Silverside, Ollaberry, 10.vi.10 (J. Waterston), body; 1 ♂, 6 ♀, Tankerness, nr. Kirkwall, Orkney, 8.vi.06 (J. Waterston), nest; 1 ♀, Berwick, 11.vi.06 (? collector), nest; all B.M. 1914.517.

TABLE 9—(*cont.*)

MOTACILLIDAE

Anthus pratensis (L.) (Meadow-Pipit)

C. gallinae, 1 ♀, Cowdenbeath, Fifeshire, 10.vi.07 (J. Waterston), nest; B.M. 1914.517; *C. garei*, 1 ♀, Lochhead, Lochgelly, 21.x.09 (J. Brown), body; B.M. 1914.517; < ♂, < ♀, Newport, I.O.W., ix.10 (H. G. Jeffrey), nest; 1 ♂, Foulness Island, 28.v.34 (W. H. Pollen), body; *D. gallinulae*, 1 ♀, Walls, Shetland, vi.06 (J. Clark, per Watkins and Doncaster), nest; 3 ♂, 7 ♀, Braid Hills, nr. Edinburgh, 2.vi.06 (J. Waterston), nest; 1 ♀, Lesmahagow, Lanarkshire, 22.vii.06 (J. Clark, per Watkins and Doncaster), nest; all Rothschild Coll.

Anthus spinoletta (L.) (Rock-Pipit)

C. gallinae, 1 ♀, Ollaberry, Shetland, 18.x.10 (J. Waterston), body; *D. gallinulae*, 1 ♂, 1 ♀, nr. Haylor, Ronas Voe, Cumberland, 13.vii.12, nest; all B.M. 1914.517.

Motacilla alba yarrelli Gould (Pied Wagtail)

C. gallinae, 5 ♂, 6 ♀. Kennetpans, Clackmannan, 6.viii.08 (J. Waterston), nest; 3 ♂, 8 ♀, Arniston, Midlothian, 8.vi.09 (A. Bennett), nest; all B.M. 1914.517; 2 ♂, Westfield, Sussex, 2.viii.07 (W. R. Butterfield); *C. garei*, 3 ♂, < ♀, Tring, Herts., 1902 (N.C.R.), nest; Tring, Herts., vii.03 (N.C.R.), nest; all Rothschild Coll.; *D. gallinulae*, 2 ♂, 7 ♀, Hillend, Fife, 26.v.06 (J. Waterston), nest; 5 ♀, nr. Loganlea Waterfall, 25.v.07 (R. Cochrane), nest; 1 ♂, Arniston, Midlothian, 28.vi.09 (A. Bennett), nest; all B.M. 1914.517; 10 ♂, 5 ♀, Lesmahagow, Lanarkshire, 20.vi.06 (J. Clark, per Watkins and Doncaster), nest; 1 ♂, Ross-shire, 20.iii.34 (W. H. Pollen), body; all Rothschild Coll.

Motacilla cinerea cinerea Tunst. (Grey Wagtail)

D. gallinulae, 1 ♂, Arniston, Midlothian, 29.vi.09 (J. Waterston), nest; B.M. 1914.517; 2 ♀, Coalburn, Lanarkshire, vi.06 (J. Clark), nest; Rothschild Coll. (B.M.).

CERTHIIDAE

Certhia familiaris (L.) (Tree-Creeper)

D. gallinulae, 1 ♀, Howick, Northumberland, 1.xi.34 (W. H. Pollen), body; Rothschild Coll. (B.M.).

SITTIDAE

Sitta europoea L. (Nuthatch)

C. gallinae, 6 ♂, 6 ♀, Hastings, Sussex, 1909 (W. R. Butterfield); Rothschild Coll. (B.M.).

PARIDAE

Parus major L. (Great Tit)

C. gallinae, < ♂, < ♀, Arniston, Midlothian, 4.vi.09 (A. Bennett), nest; B.M. 1914.517; 1 ♀, Ashbourne, Derbyshire (F. C. R. Jourdain); 2 ♂, 4 ♀, Kingsland, Herefordshire, 19.v.(? year) (R. Williams); < ♂, < ♀, Tring, Herts., ix.21 (F. J. Cox), nest; 3 ♂, < ♀, Chingford, London, 1910 (C. Nicholson); 1 ♀, Surrey, 13.vi.09 (H. Russell); < ♂, < ♀, Shere, Guildford, 13.vi.09; < ♂, < ♀, Sussex, 22.iv.08 (W. R. Butterfield); all Rothschild Coll.; 1 ♀, Perch and Nagshead, Gloucester, 28/29.vii.45 (received from Com. Inst. Ent. per Dr. K. Jordan), nest; B.M. 1914.517; < ♂, < ♀, Wembdon, nr. Bridgwater, 1902 (G. Gare); Wembdon, nr. Bridgwater, no date (G. Gare); 2 ♂, Ross-shire, 20.iii.34 (W. H. Pollen), body; < ♂, < ♀, Bere Regis, Dorset, 15.vii.19 (H. Russell); < ♂, < ♀, Dorset, vi.14 (H. Russell); all Rothschild Coll.; *D. gallinulae*, 2 ♂, 2 ♀, Cowdenbeath, 10.vi.07 (J. Waterston), nest; 1 ♂, 1 ♀, Aberdour, Fife, v.07 (J. Waterston); 1 ♂, Arniston, Midlothian, 4.vi.09 (A. Bennett), nest; all B.M. 1914.517.

Parus coeruleus L. (Blue-Tit)

C. gallinae, 8 ♂, < ♀, Kennetpans, Clackmannan, 8–10.viii.08 (J. Waterston), nest; < ♂, < ♀, Arniston, Midlothian, vi.09 (A. Bennett), nest; all B.M. 1914.517; < ♂, < ♀, Rosehill, Cheadle, Staffordshire, xii.13 (J. R. B. Masefield); < ♂, < ♀, Cardiff, 12.vi.33 (H. M. Hallett), nest; < ♂, < ♀, Ashton, Oundle, ix.02 (N.C.R.), nest; Ashton, Oundle, vi.10 (J. Stuart), nest; 1 ♀, Hockley, Essex, 18.v.03 (F. W. Frohawk); < ♂, < ♀, London, xi.09 (N.C.R.), nest; 1 ♂, 3 ♀, Chiswick, ii.01 (A. Sich); 8 ♂, 6 ♀, Hastings, Sussex, 1909 (W. R. Butterfield); < ♂, < ♀, Reading, Berks., 9.vi.39 (B. T. Parsons), nest; 1 ♂, 1 ♀, Rilla Mill, Cornwall, vi.05 (K. Jordan), nest; *D. gallinulae*, 1 ♀, Ross-shire, 20.iii.34 (W. H. Pollen), body; 3 ♂, 2 ♀, Crickleigh, Gloucester, 24.iv.04 (R. Newstead); all Rothschild Coll.

Aegithalos caudatus (L.) (Long-tailed Tit)

D. gallinulae, 5 ♂, Essex, 1910 (H. Russell); Rothschild Coll.

Panurus biarmicus (L.) (Bearded Tit)

C. garei, < ♂, < ♀, Hickling Broad, Norfolk, 8.v.16 (H. Russell), nest; 6 ♂, 4 ♀, Horeton Broad, Cromer, vii.1896 (F. H. Barclay), both Rothschild Coll.

TABLE 9—(*cont.*)

MUSCICAPIDAE

Muscicapa striata (Pall.) (Spotted Flycatcher)

C. gallinae, 1 ♀, Kinneff, Kincardineshire, 15.vi.09 (J. F. Cormack), nest; 2 ♀, Gorebridge, Dalkeith, 12.vii.06 (? collector), nest; 9 ♀, Arniston, Midlothian, 3.viii.09 (A. Bennett); *D. gallinulae*, 5 ♀, Kinneff, Kincardineshire, 5.vi.09 (J. F. Cormack), nest; 3 ♀, Gorebridge, 12.vii.06 (J. Waterston), nest; all B.M. 1914.517; 1 ♀, Lesmahagow, Lanarkshire, 5.viii.06 (J. Clark, per Watkins and Doncaster), nest; 1 ♂, 1 ♀, Tring, Herts., vii.19 (K. Jordan), nest; 1 ♂, 1 ♀, Newport, I.O.W., ix.1900 (H. G. Jeffrey), nest; all Rothschild Coll.

SYLVIIDAE

Phylloscopus collybita (Vieill.) (Chiff-Chaff)

C. gallinae, 2 ♂, 1 ♀, Devon, vi.35 (G. M. Spooner), nest; *D. gallinulae*, 8 ♂, < ♀, Lesmahagow, Lanarkshire, vii.06 (J. Clark, per Watkins and Doncaster), nest; 3 ♀, Reigate, Surrey, 12.vi.01 (C. Reeves); all Rothschild Coll.

Phylloscopus trochilus (L.) (Willow-Warbler)

D. gallinulae, 2 ♂, 3 ♀, Glencorse Pond, 3.vii.07 (R. Cochrane), nest; 1 ♂, 3 ♀, Arniston, Midlothian, 3–4.vi.09 (A. Bennett), nest; all B.M. 1914.517; < ♂, < ♀, Tring, Herts., vi.28 (K. Jordan), nest; < ♂, < ♀, Tring, Herts., vii.28 (K. Jordan), nest; all Rothschild Coll.

Phylloscopus sibilatrix (Bechst.) (Wood-Warbler)

D. gallinulae, < ♂, < ♀, Arniston, Midlothian, vi.09 (A. Bennett), nest; B.M. 1914.517.

Acrocephalus schoenobaenus (L.) (Sedge-Warbler)

D. gallinulae, 2 ♂, Tring, Herts., v.34 (L. Goodson), nest; Rothschild Coll.

Sylvia borin (Bodd.) (Garden Warbler)

D. gallinulae, 3 ♂, 4 ♀, Arniston, Midlothian, 25.vi.09 (A. Bennett), nest; B.M. 1914.517.

Sylvia communis Lath. (Whitethroat)

D. gallinulae, 1 ♀, Skokholm Bird Observatory (R. M. Lockley), body; Rothschild Coll.

Sylvia curruca (L.) (Lesser Whitethroat)

D. gallinulae, 9 ♂, 10 ♀, Tansor Wold, Oundle, v.06 (F. J. Cox), nest; Rothschild Coll.

TURDIDAE

Turdus viscivorus L. (Mistle Thrush)

C. gallinae, 1 ♂, 1 ♀, Colinton, Midlothian, 24.v.06 (J. Waterston); *D. gallinulae*, 1 ♂, 6 ♀, Hillend, Fife, 25.v.08 (R. Cochrane), nest; 2 ♀, Loganlea Waterfall, 25.v.07 (R. Cochrane), nest; all B.M. 1914.517.

Turdus ericetorum Turton (Song-Thrush)

C. gallinae, 1 ♂, Colinton, Midlothian, 7.v.06 (J. Waterston), nest; B.M. 1914.517; 1 ♀, Nethercraigs, Paisley, 4.v.09 (J. Waterston), joint nest with *T. merula*; B.M. 1914.517; < ♂, < ♀, Loch Ranza, Arran Isle, N.B., vi.27 (F. J. Cox), nests; 2 ♀, Tring, Herts., 10.xi.14 (E. Hartert); all Rothschild Coll.; *D. gallinulae*, 2 ♂, Kinneff, Kincardineshire, 14.vi.09 (J. Waterston), body; 1 ♂, 1 ♀, Colinton, Midlothian, 7.v.06 (J. Waterston), nest; 1 ♂, 3 ♀, Nethercraigs, Paisley, 4.v.09, joint nest with *T. merula*; all B.M. 1914.517; 1 ♂, 1 ♀, Crickleigh, Gloucester, 20.iv.06; Rothschild Coll.

Turdus merula L. (Blackbird)

C. gallinae, 1 ♀. St. Margaret's Hope, South Ronaldshay, Orkney, vi.06 (J. Waterston), nest; B.M. 1914.517; 2 ♂, 4 ♀, Carie, Rannoch, 23.vii.08 (F. J. Cox), nest; Rothschild Coll.; 1 ♀, Woodburn House, nr. Dalkeith, 12.v.08 nest; 1 ♂, 3 ♀, Colinton, Midlothian, 15.iv.07 (J. Waterston), nests; Colinton, Midlothian, 26.vii.09 (J. Waterston), body; 1 ♀, Nethercraigs, Paisley, 4.v.09 (J. Waterston), joint nest with *T. ericetorum*; all B.M. 1914.517; 1 ♀, Armitage, Staffordshire, i.33 (L. C. E. Stott), nest; 5 ♀, Tring, Herts., vii.1900 (N.C.R.), nest; Tring, Herts., 15.vii.11 (H. Mugford); 4 ♂, 7 ♀, Reigate, Surrey, 12.vi.18 (C. E. Stott); < ♂, < ♀, Newport, I.O.W., v.10 (H. G. Jeffrey), nest; Newport, I.O.W., ix.10 (H. G. Jeffrey), nest; < ♀, St. Mary's, Scilly Isles, 11.vi.07 (F. J. Cox), nest; all Rothschild Coll.; *C. garei*, 1 ♂, Park House, Crathorne, Yarm-on-Tees, Yorks. (? collector), nest; B.M. 1920.166 (presented by S. Hirst); 1 ♂, Newport, I.O.W., iv.10 (H. G. Jeffrey); *D. gallinulae*, 3 ♂, 3 ♀, Kilronan, Arran Is., Ireland, vii.06 (M. Mullin, per Watkins and Doncaster); 1 ♂, 1 ♀, Hillend, Fife, 18.v.06 (J. Waterston), nest; all Rothschild Coll.; 4 ♂, < ♀, Flotterstone, Fifeshire, 13.v.06 (J. Waterston), nest; 4 ♂, 5 ♀, Aberdour, Fife, 20.iv.07 (J. Waterston), nest; 1 ♀, Burntisland, 8.x.09 (Rettie); 2 ♂, 1 ♀, St. Margaret's, nr. Queensferry, 9.vi.09 (W. H. Elder), nest; all B.M. 1914.517; 3 ♂, 8 ♀, Colinton, nr. Edinburgh, 24.v.06 (J. Waterston); Colinton, nr. Edinburgh, 25.v.06 (J. Waterston); all Rothschild Coll.; 4 ♂, 2 ♀, Arniston, Midlothian, 3.vi.09 (A. Bennett), nest; Nethercraigs, Paisley, 4.v.09, joint nest with *T. musicus* (= *ericetorum*); all B.M. 1914.517; 1 ♂, 1 ♀, Tring, Herts.,

TABLE 9—(*cont.*)

15.vii.11 (H. Mugford); 1 ♂, Newport, I.O.W., iv.10 (H. G. Jeffrey), nest; all Rothschild Coll.

Oenanthe oenanthe (L.) (Wheatear)

D. gallinulae, 1 ♀, Gluss Voe, west side, Ollaberry, 28.iv.13 (J. Waterston), body; B.M. 1914.517.

Saxicola torquata (L.) (Stonechat)

D. gallinulae, < ♂, < ♀, Loudoun Estate, Ayrshire, 12.vi.09 (J. Gloag), nest; B.M. 1914.517.

Phoenicurus phoenicurus (L.) (Redstart)

C. gallinae, 1 ♀, Gorebridge, nr. Dalkeith (? collector), nest; < ♂, < ♀, Arniston, Midlothian, 25.vi.09 (? collector), nest; *D. gallinulae*, 9 ♂, < ♀, Arniston, Midlothian, 1.vii.06 (A. Bennett), nest; Arniston, Midlothian, 28.v.09 (A. Bennett), nest; all B.M. 1914.517.

Erithacus rubecula (L.) (Robin)

C. gallinae, 1 ♂, Auchinblae, Kincardineshire, 17.iv.09 (J. Duffus), nest; *D. gallinulae*, 1 ♂, 1 ♀, Auchinblae, Kincardineshire, 17.iv.09 (J. Duffus), nest; all B.M. 1914.517; 3 ♂, 3 ♀, Hillend, Fife, 29.v.06 (? collector), nest; 3 ♀, Flotterstone, Fifeshire, 29.v.06; 5 ♂, 2 ♀, Colinton, Midlothian, vi.06 (J. Waterston), nest; all B.M. 1914.517; 2 ♂, 8 ♀, Carie, Rannoch, N.B., vii.08 (F. J. Cox), nest; 1 ♀, Banbury, 4.xii.34 (W. H. Pollen), body; 2 ♂, < ♀, Loch Ranza, Arran Isle, vii.27 (F. J. Cox), nests; < ♂, < ♀, nr. Park Mill, Gower Peninsula, Glamorgan, v.19 (F. J. Cox), nest; < ♂, < ♀, Tring, Herts., 7.viii.01 (N.C.R.), nest; Tring, Herts., 3.ix.01 (N.C.R.), nest; Tring, Herts., 17.ix.01 (N.C.R.), nest; Tring, Herts., 5.x.01 (N.C.R.), nest; 1 ♂, 2 ♀, Newport, I.O.W., ix.10 (H. G. Jeffrey), nest; Newport, I.O.W., 1912 (H. G. Jeffrey), nest; all Rothschild Coll.

PRUNELLIDAE

Prunella modularis (L.) (Hedge-Sparrow)

C. gallinae, 1 ♀, Quixewood, Berwickshire, 14.v.07 (J. Waterston), nest; 5 ♀, Elveden, Suffolk, 14.viii.07 (F. J. Cox), nest; 1 ♀, Tring, Herts., 1901 (N.C.R.), nest; 4 ♂, 1 ♀, Crickleigh, Gloucester, 21.iv.06 (R. Newstead); 1 ♀, Northampton, 1.xii.34 (W. H. Pollen), body; all Rothschild Coll.; *C. garei*, 1 ♂, Newport, I.O.W., v.10 (H. G. Jeffrey); Rothschild Coll.; *D. gallinulae*, 4 ♂, 9 ♀, Hillend, Fife, 26.v.06 (J. Waterston), nest; 2 ♂, 3 ♀, Edinburgh, 12.v.08 (J. Waterston), nest; 5 ♂, 10 ♀, Colinton, Midlothian, 13.v.06 (J. Waterston); Colinton, Midlothian, 24.v.06 (J. Waterston); Colinton, Midlothian, 19.v.09 (J. Waterston); Colinton, Midlothian, 31.vi.09 (J. Waterston), body; all B.M. 1914.517; 1 ♀, Dumbarton, Scotland, 21.ix.34 (W. H. Pollen), body; Rothschild Coll.; 3 ♂, 4 ♀, Arniston, Midlothian, vi.09 (A. Bennett), nest; B.M. 1914.517; < ♂, < ♀, Talacre, nr. Prestatyn, 16.v.03 (R. Newstead); 1 ♀, Newport, I.O.W., v.10 (H. G. Jeffrey), nest; all Rothschild Coll.

TROGLODYTIDAE

Troglodytes troglodytes (L.) (Wren)

C. gallinae, 1 ♀, Lamba, Shetland, 25.ix.12 (J. Waterston), nest; B.M. 1914.517; 6 ♂, 7 ♀, Ashton, Oundle, vi.06 (F. J. Cox), nest; 2 ♂, < ♀, Tring, Herts., 5.x.01 (N.C.R.), nest; *D. gallinulae*, 2 ♂, 1 ♀, St. Kilda, 1900 (W. Eagle Clarke); all Rothschild Coll.; 1 ♀, Gluss Voe, Ollaberry, 20.ix.10 (J. Waterston), body; 4 ♂, < ♀, between Hillend and Flotterstone, Fifeshire, 29.v.06 (J. Waterston), nest; 2 ♂, 3 ♀, nr. Loganlea Waterfall, 25.v.07 (J. Waterston), nest; all B.M. 1914.517; 1 ♀, Lesmahagow, Lanarkshire, 5.viii.06 (J. Clark, per Watkins and Doncaster), nest; Rothschild Coll.; 1 ♂, Pettadale Water, nr. R. Roe, 24.iv.12 (J. Waterston), body; B.M. 1914.517; 1 ♂, 1 ♀, Cardiff, 14.vi.31 (H. M. Hallett, A. H. Salmon); 2 ♀, Tring, Herts., vi.01 (N.C.R.), nest; all Rothschild Coll.

CINCLIDAE

Cinclus cinclus (L.) (Dipper)

C. gallinae, 1 ♀, Auchinblae, Kincardineshire, 14.iv.09 (L. Duffus), nest; 1 ♂, Abbey St. Bathans, Berwickshire, 26.v.07; all B.M. 1914.517; 1 ♂, 1 ♀, Rothbury, Sunderland, vii.06 (per Watkins and Doncaster), Rothschild Coll.; *D. gallinulae*, 9 ♂, < ♀, Torduff Reservoir, Midlothian, 12.v.09 (J. Waterston), nest; B.M. 1914.517; 1 ♀, nr. Granthouse, 14.v.07 (J. Waterston), nest; B.M. 1914.517; 1 ♀, Nantyffrith, nr. Minera, Flintshire, 5.v.01 (R. Newstead); Rothschild Coll.

HIRUNDINIDAE

Hirundo rustica L. (Swallow)

C. gallinae, 2 ♂, 7 ♀, Dirleton, East Lothian, 2.ix.09 (J. Gardiner), nest; 3 ♂, 7 ♀, Howletburn, Galston, Ayrshire, 4.ix.10 (J. Gloag), nest; all B.M. 1914.517; 8 ♂, < ♀, Newport, I.O.W., 1912 (H. G. Jeffrey), nest; Newport, I.O.W., 1914 (H. G. Jeffrey), nest; all Rothschild Coll.

Delichon urbica (L.) (House-Martin)

C. gallinae, 7 ♂, 5 ♀, Mull, Argyllshire, ix.12 (L. G. Esson); Mull, Argyllshire, 7.i.13 (L. G. Esson); all Rothschild Coll.; 2 ♂, 4 ♀, Gladhouse,

TABLE 9—(*cont.*)

Midlothian, 13.viii.06 (J. Waterston), nest; B.M. 1914.517; < ♂, < ♀, Dunlaverock, Berwickshire, ix.06 (J. Waterston), nest; Rothschild Coll.; 9 ♂, 10 ♀, Dunlaverock, Coldingham, 24.ix.06 (J. F. Cormack), nest; Dunlaverock, Coldingham, viii.09 (J. F. Cormack), nest; Dunlaverock, Coldingham, ix.09 (J. F. Cormack), nest; 1 ♂, 1♀, Dunlaverock, Coldingham, 2.viii.10 (J. F. Cormack); all B.M. 1914.517; 10 ♂, 6 ♀, Ashton, Oundle, viii.06 (F. J. Cox), nest; Rothschild Coll.

Riparia riparia (L.) (Sand-Martin)

C. gallinae, 5 ♂, Reigate, Surrey, ix.25 (L. C. E. Stott); Rothschild Coll.

APODIDAE

Apus apus (L.) (Swift)

C. gallinae, 3 ♂, 8 ♀, Newport, I.O.W., 1913 (H. G. Jeffrey), nest; 2 ♂, 5 ♀, Wembdon, nr. Bridgwater, 3.vii.01 (G. Gare); Wembdon, nr. Bridgwater, 1902 (G. Gare); all Rothschild Coll.

PICIDAE

Picus viridis L. (Green Woodpecker)

C. gallinae, 1 ♀, Northampton, 25.v.34 (W. H. Pollen), body; Rothschild Coll.

Jynx torquilla (L.) (Wryneck)

C. gallinae, < ♂, < ♀, Wembdon, nr. Bridgwater, 1902 (G. Gare); *C. garei*, 1 ♀, Wembdon, nr. Bridgwater, 1902 (G. Gare); all Rothschild Coll.

STRIGIDAE

Asio otus (L.) (Long-eared Owl)

C. gallinae, < ♂, < ♀, Newport, I.O.W., ix.10 (H. G. Jeffrey), nest; Newport, I.O.W., 1912 (H. G. Jeffrey), nest; all Rothschild Coll.

Tyto alba (Scop.) (Barn-Owl)

C. gallinae, 2 ♂, 4 ♀, Ashton Wold, Oundle, vi.26 (F. J. Cox), nest; < ♂, < ♀, Tring, Herts., summer, 1919 (F. J. Cox), nest; 2 ♂, Reigate, Surrey, 10.viii.1900 (C. Reeves); 9 ♂, 10 ♀, Hastings, Sussex, 1909 (W. R. Butterfield); all Rothschild Coll.

Strix aluco L. (Tawny Owl)

C. gallinae, < ♂, < ♀, Arniston, Midlothian, iv.09 (A. Bennett), nest; Arniston, Midlothian, vi.09 (A. Bennett), nest; all B.M. 1914.517; 1 ♂, 1 ♀, Upton, nr. Chester, 25.v.05; 4 ♀, Tring, Herts. (M.R.), nest; 2 ♂, 7 ♀, Tring, Herts., 1936 (M.R.); 1 ♂, Northampton, 21.iv.34 (W. H. Pollen), body; all Rothschild Coll.

Athene noctua (Scop.) (Little Owl)

C. gallinae, 1 ♀, Northamptonshire, 22.v.34 (W. H. Pollen), body; 5 ♂, 4 ♀, Northamptonshire, 12.iv.34 (W. H. Pollen), body; all Rothschild Coll.

FALCONIDAE

Accipiter nisus (L.) (Sparrow-Hawk)

C. gallinae, 1 ♂, Bradford, Yorks., viii.29 (N. H. Joy), nest; < ♂, 2 ♀, Tring, Herts., summer, 1919 (N.C.R.), nest; < ♂, < ♀, Newport, I.O.W., 1912 (H. G. Jeffrey), nest; 1 ♀, Norfolk, 18.iv.34 (W. H. Pollen), body; *D. gallinulae*, 1 ♂, Beaconsfield, Buckinghamshire, 16.vii.34 (W. H. Pollen), body; all Rothschild Coll.

ANATIDAE

Anas platyrhyncha L. (Mallard)

C. garei, 2 ♂, 3 ♀, Lochgelly, Fifeshire, 25.v.09 (J. Brown), nest; B.M. 1914.517 < ♂, < ♀, Tring, Herts., vii.03 (F. J. Cox), nest; Tring, Herts., v.05 (N.C.R.), nest; all Rothschild Coll.

Anas acuta L. (Pintail)

C. garei, 6 ♂, 3 ♀, Orkney Islands, vi.11 (N. H. Joy), nest; Rothschild Coll.

Aythya fuligula (L.) (Tufted Duck)

C. garei, < ♂, < ♀, Merton, Oxford, vi. (? date) (Lord Walsingham); 1 ♀, Thetford, Norfolk, 2.vi. (? date) (per British Museum); all Rothschild Coll.

Somateria mollissima (L.) (Common Eider)

C. garei, 4 ♂, Orkney Islands, vi.11 (N. H. Joy), nest; Rothschild Coll.; 1 ♂, 1 ♀, Tankerness, Pomona, 8.vi.06 (J. Waterston), nest; B.M. 1914.517; 8 ♂, < ♀, Bass Rock, Firth of Forth, vii.26 (F. J. Cox), nest; Rothschild Coll.

Melanitta nigra (L.) (Common Scoter)

C. garei, < ♂, < ♀, Little Roe, Shetland, vii.10 (J. Waterston), nest; Rothschild Coll.

Mergus serrator L. (Red-breasted Merganser)

C. garei, 1 ♀, Belfast, Ireland, 2.vi.34 (W. H. Pollen), body; Rothschild Coll.

PHALACROCORACIDAE

Phalacrocorax aristotelis (L.) (Shag)

C. garei, < ♂, < ♀, Lamba Island, Shetland, vii.12, nest; < ♂, < ♀, Lamba Island, Shetland, xii.13, nest; all B.M. 1914.517; < ♂, < ♀, Orkney Islands, vi.11 (N. H. Joy), nest; Rothschild Coll.

TABLE 9—(*cont.*)

HYDROBATIDAE

Hydrobates pelagicus (L.) (Storm-Petrel)

C. gallinae, 1 ♂, Borough of Copister, SE. end of Yell, opposite Mossbank, Shetland, 25.vii.13 (J. Waterston and Captain Jensen), nest; B.M. 1914.517.

Fulmarus glacialis (L.) (Fulmar Petrel)

C. gallinae, 1 ♀, Ross-shire, 5.i.35 (W. H. Pollen), body; Rothschild Coll.; *D. gallinulae*, 2 ♂, Uyea Island, Shetland, 24.iv.12 (J. Waterston), body; Uyea Island, Shetland, vi.12 (J. Waterston), near nest; all B.M. 1914.517.

COLUMBIDAE

Columba palumbus L. (Wood-Pigeon)

C. gallinae, 6 ♀, Berkshire, 11.iv.34 (W. H. Pollen), body; Rothschild Coll.

Columba oenas L. (Stock-Dove)

C. gallinae, 1 ♀ Colinton, Midlothian, 19.v.09 (J. Waterston), nest; Rothschild Coll.

Columba livia Gm. (Rock-Dove)

C. gallinae, < ♂, < ♀, Little Roe, Yell Sound, Shetland, 17.vii.11 (J. Waterston), nest; 1 ♀, Caves in cliffs, Todhead, Kinneff, 15.vi.09 (J. Waterston), nest; all B.M. 1914.517; 1 ♀, Belfast, Ireland, 24.v.35 (W. H. Pollen), body; *C. garei*, 4 ♂, < ♀, Little Roe, Shetland, 17.vii.11 (J. Waterston), nests; *D. gallinulae*, 4 ♂, 5 ♀, in a cave NE. end of Little Roe, Shetland, 17.vii.11 (J. Waterston), nest; all Rothschild Coll.

SCOLOPACIDAE

Scolopax rusticola L. (Woodcock)

D. gallinulae, 8 ♂, < ♀, Aberdour, Fifeshire, 25.v.07 (J. Waterston), nest; B.M. 1914.517.

Capella gallinago (L.) (Snipe)

C. garei, 1 ♀, Northmavine, Shetland (R. H. McNair); 5 ♀, Tankerness, Orkney, 8.vi.06 (J. Waterston), nest; < ♂, < ♀, Lochgelly, Fifeshire, 25.v.09 (J. Brown), nest; all B.M. 1914.517.

Calidris alpina (L.) (Dunlin)

C. garei, < ♂, < ♀, Tinga Skerry, Yell Sound, Shetland, 11.vii.12 (J. Waterston), nest; B.M. 1914.517.

Tringa totanus (L.) (Redshank)

C. garei, 1 ♂, 2 ♀, Lochgelly, Fifeshire, 25.v.09 (J. Brown), nest; B.M. 1914.517.

Charadrius hiaticula L. (Ringed Plover)

C. garei, 1 ♀, Ollaberry, Shetland, 22.ix.10 (J. Waterston), body; 1 ♀, Aberlady, nr. Edinburgh, 22.v.09 (J. F. Cormack), nest; all B.M. 1914.517.

Vanellus vanellus (L.) (Lapwing)

C. garei, 2 ♂, Tents Moor, Fifeshire, 12.vi.09 (J. F. Cormack), nest; 4 ♂, 5 ♀, Lochhead, Lochgelly, Fifeshire, 25.iii.09 (J. Brown), nest; 5 ♂, 3 ♀, Aberlady, nr. Edinburgh, 22.v.09 (J. F. Cormack), nests; Aberlady, nr. Edinburgh, 10.v.10 (J. F. Cormack), nest; all B.M. 1914.517.

LARIDAE

Larus ridibundus L. (Black-headed Gull)

C. garei, 1 ♀, Orkney Islands, vi.11 (N. H. Joy), nest; Rothschild Coll.

Larus canus L. (Common Gull)

C. garei, < ♂, < ♀, Little Roe, Shetland, v.11 (J. Waterston), nest; B.M. 1914.517.

Larus fuscus L. (Lesser Black-backed Gull)

C. garei, 3 ♂, 7 ♀, Walls, Shetland, viii.06 (per Watkins and Doncaster), nest; Rothschild Coll.

STERCORARIIDAE

Stercorarius parasiticus (L.) (Arctic Skua)

C. garei, < ♂, < ♀, Hascussay, Shetland, 7.vii.11 (M. Meade-Waldo); Rothschild Coll.

Crex crex (L.) (Corn-Crake)

C. garei, < ♂, < ♀, found by taxidermist in Nat. Hist. Mus., London; body; Rothschild Coll.

RALLIDAE

Gallinula chloropus (L.) (Moorhen)

C. gallinae, 1 ♂, 5 ♀, Ashton, Oundle, v.06 (F. J. Cox), nest; Rothschild Coll.; *C. garei*, < ♂, 9 ♀, Arniston, Midlothian, 26.vii.06 (A. Bennett), nest; 1 ♂, 3 ♀, on the Eye, Granthouse, Berwickshire, 14.v.07, nest; all B.M. 1914.517; 2 ♀, Ashton, Oundle, vi.06 (F. J. Cox), nest; 2 ♂, 5 ♀, Tring, Herts., vii.02 (N.C.R.), nest; all Rothschild Coll.; *D. gallinulae*, 5 ♀, Glencorse Pond, 29.v.06 (J. Waterston), nest; 1 ♂, 4 ♀, Arniston, Midlothian, 29.vi.09 (J. Waterston), nest; all B.M. 1914.517; 2 ♂, Ashton, Oundle, v.06 (F. J. Cox), nest; Rothschild Coll.

TETRAONIDAE

Lagopus scoticus (Lath.) (Red Grouse)

C. garei, 2 ♂, 6 ♀, Tankerness, Orkney, 8.vi.06 (J. Waterston), nest; B.M. 1914.517; 1 ♂, 1 ♀,

TABLE 9—(*cont.*)

Perth, Scotland, 2.vii.07 (A. E. Shipley); *D. gallinulae*, 1 ♀, Tankerness, nr. Stromness, Kirkwall, Orkney, 4.vi.06 (J. Waterston), nest; 1 ♂, (A. E. Shipley); all Rothschild Coll.

PHASIANIDAE

Phasianus colchicus L. (Pheasant)

C. gallinae, 1 ♂, 1 ♀, Cowdenbeath, Fifeshire, 10.vi.07 (J. Waterston), nest; B.M. 1914.517; 3 ♀, Windsor Forest, v.30 (H. Donisthorpe), nest; Rothschild Coll.; *C. garei*, 2 ♂, 5 ♀, Lochgelly, Fifeshire, 25.v.09 (J. Brown), nest; 1 ♀, Arniston, Midlothian, 28.v.09 (A. Bennett), nest; 1 ♂, 1 ♀, Aberlady, nr. Edinburgh, 22.v.09 (J. F. Cormack), nest; all B.M. 1914.517; 1 ♀, Tring, Herts., summer, 1919 (F. J. Cox), nest; 1 ♂, 1 ♀, Windsor Forest, v.30 (H. Donisthorpe), nest; *D. gallinulae*, 1 ♀, Ross-shire, 4.i.35 (W. H. Pollen), body; 1 ♀, Aberdour, Fifeshire, 25.v.07 (J. Waterston), nest; all Rothschild Coll.

Perdix perdix (L.) (Common Partridge)

C. garei, 1 ♀, banks of Bervie, Arbuthnot, Kincardineshire, 14.vi.09, nest; B.M. 1914.517; < ♂, < ♀, Ashton Wold, Oundle, vi.19 (J. Stuart), nest; 9 ♂, < ♀, Newport, I.O.W., ix.1900 (H. G. Jeffrey); all Rothschild Coll.

Alectoris rufa (L.) (Red-legged Partridge)

C. garei, < ♂, < ♀, Tring, Herts., summer, 1911 (F. J. Cox), nest; Rothschild Coll.

DOMESTIC POULTRY

Gallus domesticus L. (Fowl)

C. gallinae, 1 ♂, 3 ♀, Kinneff, Kincardineshire, 14.vi.09 (J. R. Frazer), nest; 2 ♂, 6 ♀, Dirleton, East Lothian, 2.ix.09 (J. Gardiner), nest; 1 ♀, Colinton, Midlothian, 24.v.06 (J. Waterston), nest; 5 ♂, 9 ♀, Biggar, Lanarkshire, 10.ix.09, nest; all B.M. 1914.517; 1 ♀, Buckingham, 29.v.01 (L. W. Rothschild); < ♂, 2 ♀, Tring, Herts., 7.xii.1899 (N.C.R.), nest; Tring, Herts., 1901 (N.C.R.), nest; all Rothschild Coll.; 6 ♂, < ♀, Woking, Surrey; B.M. 1910.266 (Edward Saunders Coll.); 4 ♀, Richmond, viii. 36; < ♂, < ♀, Newport, I.O.W., 1912; all Rothschild Coll.

from one bird), *C. garei* (1), *D. g. gallinulae* (several), *C. farreni* (2), *C. rusticus* (1), *C. columbae* (1), and *M. sciurorum* (1). No other bird in Britain has such an impressive list of 'stragglers' except the Puffin (*Fratercula arctica*) which nests in burrows under conditions particularly favouring straggling.

A bird, on the other hand, which may possibly be unattractive to fleas is the Swift (*Apus apus*). It is classified among Nordberg's hole or half-hole nesters, and has a fairly high nidicolous fauna. Furthermore the sites chosen, the tendency to return year after year to the old nest and to breed in colonies, and also the close texture of the nest, should all contribute—as indeed they do in the case of the House-Martin—to a rich flea-fauna, both with regard to the number of species and to the size of the flea population. The very reverse is true, since the only fleas found in the nest of the Swift are *C. gallinae* and *C. fringillae*, which are no doubt acquired from the old Sparrows' nests of which the Swift often makes use if they are situated in suitable holes or cracks (Witherby, 1938).

Another curious fact is the absence of *C. garei* from the nests of the Herring-Gull. This flea has been recorded from *L. ridibundus*, *L. canus*, *L. marinus*, and *L. fuscus* in Britain, but the only record of *C. garei* from the Herring-Gull (Waterston, 1910) has proved on re-examination of the specimens to refer to atypical females, probably of *C. borealis* (Rothschild, 1948). Owing to the search for *C. vagabunda* we have a number of negative records of the Herring-Gull's nest—negative as far as *C. garei* is concerned. There are sixteen such records from R. M. Allan and a further nine (at least) from E. O'Mahony. Is there some unknown factor about the Herring-Gull or its nest which suits *C. vagabunda* but not *C. garei*?

Swans, also, seem unattractive to bird-fleas, and although their nests are accessible and frequently searched no fleas have been recorded from the genus *Cygnus* in any part of the world. The same applies to the Kingfishers (*Alcedo*).

Seasonal variation in numbers. The monthly records of fleas found on the bodies of British birds by the three chief collectors are set out in Table 10. Fleas are seen to occur in every month of the year, but the lack of negative records and the smallness of the numbers make it impossible to compile seasonal frequencies. Colonel Meinertzhagen has informed me that most of his collecting was done in the months of April, August, and October. Thus, for example, out of 131 specimens of *Sturnus v. zetlandicus*, 111 were shot in August. The record of ten infested birds in March (Table 10) is nevertheless interesting, since nesting of the species concerned has scarcely commenced, although some individuals may be visiting old sites. It is to be expected that the peak of infestation occurs in the breeding-season. Three additional midwinter records not included in Table 10 are available, *C. gallinae* from the Siskin (*Carduelis spinus*) in February (Dale, 1878), the same species—a heavy infestation—from the Black Redstart (*Phoenicurus ochrurus gibraltariensis*) in November (Williamson, 1939), and a specimen of *C. garei* from the Blackbird also in November (Turk, 1946). These winter records, although few in number, do prove conclusively that fleas may be present on the bodies of birds all the year round.

Fleas on passage migrants. Two of Colonel Meinertzhagen's records come from migrant birds—a male *C. gallinae* from *Sylvia b. borin* and a female *C. gallinae* from *Sylvia n. nisoria* shot in the Shetlands in August, 1939. Since Colonel Meinertzhagen was at the time collecting specimens for the purpose of studying the British races of birds, he avoided as far as possible shooting migrants, and the total is therefore deceptive. Mr. O'Mahony has kindly sent me two unpublished records of a male and a female *D. g. gallinulae* collected from two migrant Wheatears (*Oenanthe oenanthe*) from Fair Isle in August 1950. Two separate records of *D. g. gallinulae* (without dates) from the body of *Sylvia communis* taken by R. M. Lockley at Skokholm Bird Observatory were from migrants. The Black Redstart referred to above was one of a party of migrants which reached the Isle of Man on 12 November. There is no reason to suppose that migrant birds are free from fleas, and in fact the contrary is indicated.

Time spent on the host's body. It is a matter of interest that *D. g. gallinulae* is more closely associated with the body of the host than either of the other two common bird-fleas (Table 4) and probably spends relatively less time in the nest. This may be one of the reasons why it has succeeded in spreading from the New World to the Old. In 1911 K. Jordan and C. Rothschild found several larvae of *D. g. gallinulae* feeding on the epidermis under the wings of a dead nestling Blackbird, another piece of evidence possibly suggesting a closer association with the host itself than is usual with bird-fleas. Living nestlings are rarely examined for flea larvae. Another matter concerning this species which is worth investigating is the question of its breeding-season. It was first shown by Bacot (1914) and later confirmed by Ioff (1939) that *C. gallinae*, unlike many mammal fleas, has a fixed breeding-season, which coincides with the spring and summer nesting-season of its hosts, and which cannot be altered under laboratory conditions by a rise or fall in temperature. *Dasypsyllus*, unlike *Ceratophyllus*, is a tropical genus and it would be of interest to know whether *D. g. gallinulae* has acquired a fixed spring breeding-season like *C. gallinae* in the Palearctic Region.

TABLE 10

Monthly Records of C. gallinae,* C. garei, *and* D. g. gallinulae *from the Bodies of Bird Hosts in Britain*

Collectors	*J.*	*F.*	*M.*	*A.*	*M.*	*J.*	*J.*	*A.*	*S.*	*O.*	*N.*	*D.*
T. Clay & R. Meinertzhagen	3	1	5	16	4	8	1	22	0	12	5	0
W. H. Pollen	3	0	5	5	5	1	1	0	1	0	1	3
J. Waterston	0	0	0	3	1	5	1	0	3	2	0	0
TOTAL	6	1	10	24	10	14	3	22	4	14	6	3

* Records from domestic fowl omitted.

Sex-ratio. In all large collections of Ceratophyllid bird-fleas from nests the females are found to predominate, and there is probably a real divergence in the sex-ratio of these species. In the case of mammal fleas the sex-ratio is often estimated from the relative numbers on the bodies of the host, and in such cases the difference may be more apparent than real. It has been shown, for instance, that the sex-ratio of *X. cheopis* on the bodies of rats alters according to climatic conditions, males predominating on hot days and females on cold days (Cole, 1945), although there is evidence that in the population as a whole the sexes occur in equal numbers. Mammals are continually returning to their flea-infested lairs, nests, burrows, and runs, and thus have the opportunity of acquiring fresh fleas or reacquiring specimens that have moved off previously. In the case of birds, once the breeding-season is over the chances of acquiring or 'changing' fleas must be greatly reduced. We may therefore expect the sex-ratio of fleas on the bodies of birds to remain fairly constant throughout the year. The marked difference between the proportion of males of *D. g. gallinulae* on the bird and in the nest may in this case reflect a divergence in the feeding-habits of the sexes. There is another point worth remembering in connexion with bird-fleas. The sexes copulate freely on emerging from their cocoons, with or without a blood meal, and therefore a single female carried through the winter on the body of a host may be capable of laying fertile eggs in the nest in the following spring without the presence of a male *at that time*, since she was probably fertilized the previous spring in the nest. It has been shown that sperm is stored in the spermatheca and released when the eggs are about to be laid. It would be interesting to know how long the sperm of bird-fleas remains viable in nature. In the laboratory *Pulex irritans* has been known to lay fertile eggs sixty-five days after copulation (Bacot, 1914).

Proportion of birds infested with fleas. Another question which springs to mind concerns the actual proportion of birds which carry fleas on their bodies. This must vary according to the species. We can deduce that House-Martins and Starlings, for example, are more heavily infested than most species, and that the peak of infestation occurs during the breeding-season. The figures in Table 4 do not give us any information on this subject, because there are no negative records available. Apparently few British flea collectors, unlike the collectors in East Africa (see p. 213), keep negative records. The relative data for nine species have been supplied by Miss T. Clay (Table 11). The infestation rate may be slightly higher than usual, since a large proportion of the collecting was done in April and August. The monthly returns for the Great Tit (Table 12) show that in the case of this bird collecting happened to be rather more evenly spread out, and the preponderance of specimens shot in April is not so marked. This gives a truer picture of the infestation rate, but unfortunately positive winter records are altogether lacking for this species. It will be seen from Table 11 that nearly 7 per cent. of 445 Passerines examined carried fleas on their bodies, and this is probably a fair estimate for the whole order in Britain. In the case of the Hirundinidae the proportion may well be greater.

TABLE 11

Proportion of Birds infested with Fleas

(*Collected by Colonel Meinertzhagen and Miss T. Clay*)

Name of bird	*Total shot*	*Total infested*
Corvus f. frugilegus L. Rook	18	1
Corvus monedula spermologus Vieill. Jackdaw	36	2
Sturnus vulgaris zetlandicus Hart. Shetland Starling	135	4
Emberiza citrinella nebulosa Gengler Yellow-Hammer	56	4
Passer d. domesticus (L.) House-Sparrow	35	3
Parus major newtoni Prazak British Great Tit	66	7
Prunella modularis occidentalis (Hart.) British Hedge-Sparrow	90	6
Delichon u. urbica (L.) House-Martin	7	2
Riparia r. riparia (L.) Sand-Martin	2	1

TABLE 12

Proportion of Great Tits (Parus major newtoni) *infested with Fleas*

(*Collected by Colonel Meinertzhagen and Miss T. Clay*)

Parus major newtoni Prazak British Great Tit	*J.*	*F.*	*M.*	*A.*	*M.*	*J.*	*J.*	*A.*	*S.*	*O.*	*N.*	*D.*
Number uninfested	11	2	9	12	3	2	3	5	1	3	8	7
Number infested	—	—	1	5	—	1	1	—	—	—	—	—
Total shot	11	2	10	17	3	3	4	5	1	3	8	7

REFERENCES

ALLAN, R. M. 1950. *Fleas (Siphonaptera) from birds in north-east Scotland. *Scot. Nat.* **62:** 33–41; fig. 1.

BACOT, A. W. 1914. A study of the bionomics of the common rat fleas and other species associated with human habitations, with special reference to the influence of temperature and humidity at various periods of the life history of the insect. *J. Hyg. Camb.* Plague Suppl. **3**: 447–654, pls. 27–34; 3 figs.

BOHEMAN, C. H. 1866. Spetsbergens Insekt-Fauna. *Öfvers. VetenskAkad. Förh. Stockh.* **22** (8): 563–580; taf. 35, fig. 1.

BOYD, A. W. 1935*a*. *Notes on the Tree-Sparrow, 1934. *Brit. Birds,* **28** (11): 347–349.

—— 1935*b*. *Report of the Swallow enquiry 1934. *Brit. Birds,* **29** (1): 3–21.

BRITTEN, H. 1920. *Siphonaptera. Records in the Counties of Cumberland, Westmorland, Lancashire & Cheshire. *Lancs. Chesh. Nat.* **13:** 100–105.

—— 1935. *Parasites of Swallows and animals found in their nests. *Brit. Birds,* **29** (1): 16–18.

BUXTON, P. A. 1938. Quantitative studies on the biology of *Xenopsylla cheopis* (Siphonaptera). *Indian J. Med. Res.* **26** (2): 505–530; figs. 1–3.

CARR, J. W. 1916. **The invertebrate fauna of Nottinghamshire.* Nottingham. 481. (Fleas determined by N. C. Rothschild.)

CARRICK, R. 1939. *Some parasites of birds and mammals from Canna. *Scot. Nat.* **1939:** 23–24. (Malloph., Siphonapt.) (Fleas determined by Karl Jordan.)

COLE, L. C. 1945. The effect of temperature on the sex ratio of *Xenopsylla cheopis* recovered from live rats. *Publ. Hlth. Rep., Wash.* **60** (45): 1337–1342.

COOREMAN, J. 1947. [Note on *C. garei.*] *Bull. et Ann. Soc. Ent. Belgique,* **83:** 111.

DALE, C. W. 1878. **The history of Glanville's Wootton . . . Dorset, including its zoology and botany.* viii+392 pp., figs. 1–2. London.

DAMPF, A. 1911. Aphaniptera, in: KÖNIG, A. F., *Avifauna Spitzbergensis. Forschungsreisen nach der Bären-Inseln und dem Spitzbergen-Archipel mit ihren faunistischen und floristischen Ergebnissen*: 276–279.

EDNEY, E. B. 1947*a*. Laboratory studies on the bionomics of the Rat Fleas, *Xenopsylla brasiliensis* Baker and *X. cheopis* Rothschild. II. Water relations during the cocoon period. *Bull. ent. Res.* **38** (2): 263–280; figs. 1–2.

—— 1947*b*. Laboratory studies on the bionomics of the Rat Fleas, *Xenopsylla brasiliensis* Baker and *X. cheopis* Rothschild. III. Further factors affecting adult longevity. *Bull. ent. Res.* **38** (3): 389–404.

EDWARDS, F. W. 1925. *Insects inhabiting birds' nests. *Trans. Herts. Nat. Hist. Soc.* **18:** 132–133.

EVANS, W. 1904. *Some Pulicidae (Fleas) from the Edinburgh district. *Ann. Scot. Nat. Hist. Soc.,* 1904: 193.

—— 1906*a*. *Some further records of Siphonaptera (Fleas) from the Forth Area. *Ann. Scot. Nat. Hist. Soc.,* 1906: 161–163. (Determined by N. C. Rothschild.)

—— 1906*b*. *Further Siphonaptera (Fleas) from 'Forth'. *Ann. Scot. Nat. Hist. Soc.,* 1906: 241.

FREEMAN, R. B. 1939. *Siphonaptera of the Oxford district. *Proc. Ashmol. Nat. Hist. Soc.* **1939:** 19–24.

—— 1941. *The distribution of *Orchopeas wickhami* (Baker) (Siphonaptera) in relation to its host the American grey squirrel. *Ent. mon. Mag.* **77,** 1941: 82–89, 1 pl.

GIBBS, A. E., and BARRAUD, P. J. 1908. *A preliminary list of Hertfordshire Diptera. *Trans. Herts. Nat. Hist. Soc.* **13** (4): 249–276.

HALLETT, H. M. 1936. *Insects of Glamorgan. In: *Glamorgan County History,* **1:** 312–375.

HOLLAND, G. P. 1949*a*. *The Siphonaptera of Canada.* Publication 817, Technical Bulletin 70, issued September 1949. (Dominion of Canada, Department of Agriculture.) Pp. 306; 42 pls.

—— 1949*b*. A revised check list of the fleas of British Columbia. *Proc. Ent. Soc. B.C.* (1948), **45:** 7–14.

* Papers containing records of British bird-fleas.

Ioff, I. G. 1941. *The ecology of fleas in connection with their epidemiological importance* (in Russian). Piatigorsk, Ordzhonikidze Kraev. Izd., 116 pp., 9 figs.

—— and Tiflov, V. E. 1938. *Manual for the determination of fleas (Aphaniptera) of the south-eastern European part of the U.S.S.R.* (in Russian). Inst. Microbiol. Epidem. S.E.U.S.S.R., Saratov, 116 pp.; 157 figs.

Jeffery, H. G. 1923. *Diptera: Pulicidae (Fleas). *Proc. Is. Wight Nat. Hist. Soc.* **1:** 123–124. (Determined by N. C. Rothschild.)

Jolley, A. E., and Storer, R. 1945. *Report on the Sand-Martin Enquiry, 1944. *Leicestershire & Rutland County Report on Wild Birds for 1944*: 10–21.

Jordan, K. 1925. New Siphonaptera. *Novit. zool.* **32:** 96–112, figs. 1–46.

—— 1926. New Siphonaptera. *Novit. zool.* **33:** 385–394; figs. 1–22.

—— 1928. Siphonaptera collected in the Dolomites. *Novit. zool.* **34:** 173–177; figs. 1–6.

—— 1929*a*. On some problems of distribution, variability and variation in North American Siphonaptera. *Trans. 4th Int. Congr. Ent.* (1928), **2:** 489–499; figs. 1–11.

—— 1929*b*. Further records of North American bird fleas, with a list of the Nearctic birds from which fleas are known. *Novit. zool.* **35:** 89–92.

—— 1929*c*. Notes on North American fleas. *Novit. zool.* **35:** 28–39; 2 pls.

—— 1929*d*. On a small collection of Siphonaptera from the Adirondacks, with a list of the species known from the state of New York. *Novit. zool.* **35:** 168–177; figs. 5–8.

—— 1932. Die aus der arktischen Zone bekannten Flöhe. *Fauna Arctica, Jena,* **6** (2): 115–118.

—— 1937. Three new bird fleas from Kashmir. *Novit. zool.* **40:** 299–306; figs. 87–92.

—— and Rothschild, N. C. 1911. List of Siphonaptera collected in Portugal. *Novit. zool.* **18:** 551–554; figs. 1–3.

—— 1920*a*. On American Bird-Ceratophylli. *Ectoparasites,* **1:** 65–76; figs. 65–72.

—— 1920*b*. A preliminary catalogue of the Siphonaptera of Switzerland. *Ectoparasites,* **1:** 78–122; figs. 75–101.

Malloch, J. R. 1907. *Diptera in Dumbartonshire in 1906. *Ent. mon. Mag.* **43:** 86. (Fleas determined by N. C. Rothschild.)

Nordberg, S. 1934. Aphanipterologisches aus Finnland. I. Verzeichnis der bisher in Finnland gefundenen Aphanipteren nebst Diagnosen über 8 für die Wissenschaft neue Arten. *Memor. Soc. Fauna Flor. Fenn.* **10:** 354–369; 15 figs.

—— 1936. Biologisch-ökologische Untersuchungen über die Vogelnidicolen. *Acta Zool. Fenn.* **21:** 1–168; 4 figs., 20 diagrams.

Nuttall, G. H. F., Strickland C., and Merriman, G. 1913. *Observations on British rat-fleas. *Parasitology,* **6:** 1–19.

O'Mahony, E. 1939*a*. *A preliminary list of Irish fleas. *Ent. mon. Mag.* **75:** 124–126.

—— 1939*b* *Notes on Irish Siphonaptera, I. *Ent. mon. Mag.* **75:** 253–254.

—— 1941*a*. *Notes on Irish Siphonaptera, III. *Ent. mon. Mag.* **77:** 208.

—— 1941*b*. *Notes on Irish Siphonaptera, IV. *Ent. mon. Mag.* **77:** 231.

—— 1948. *Some miscellaneous Siphonaptera. *Ent. mon. Mag.* **84:** 89.

—— 1949*a*. *The fleas of North Bull Island, Dublin Bay. *Ent. mon. Mag.* **85:** 139–140.

—— 1949*b*. *Ectoparasites from Fair Island. *Ent. mon. Mag.* **85:** 140.

Philip, C. B. 1938. A parasitological reconnaissance in Alaska with particular reference to varying Hares. II. Parasitological data. *J. Parasit.* **24:** 483–488. (*C. vagabunda* Boh. determined by K. Jordan.)

Rothschild, M. 1947. *A note on *Ceratophyllus rusticus* Wagner, 1903 (Siphonaptera) at Ashton Wold. *Entomologist,* **80:** 253–255.

—— 1948. *Bird fleas collected by Miss Theresa Clay, Colonel Richard Meinertzhagen, and Captain W. H. Pollen in the Island of Ushant, Brittany, France, with a note on the distribution of *Ceratophyllus borealis* Rothschild, 1907. *Entomologist,* **81:** 84–95; figs. 1–3.

—— and Clay, T. (in press). **Fleas, flukes and cuckoos.* (New Naturalist Series.) London.

Rothschild, N. C. 1900. *Notes on *Pulex avium* Tasch. *Novit. zool.* **7:** 539–543.

—— 1901. *A new British flea (*Ceratophyllus newsteadi*). *Ent. Rec.* **13:** 284; 1 pl.

—— 1902. *New British fleas. *Ent. mon. Mag.* **38:** 225; figs. 1–7. (*Ceratophyllus garei.*)

* Papers containing records of British bird-fleas.

ROTHSCHILD, N. C. 1903. *Types of Siphonaptera in the Daleian collection. *Ent. mon. Mag.* **39:** 144–146.

—— 1906. *A new British flea: *Ceratophyllus insularis*, spec. nov. *Ent. mon. Mag.* **42:** 59–60, 1 pl.

—— 1912. A note on *Ceratophyllus vagabundus*, Boheman. *Ent. mon. Mag.* **48:** 67.

—— 1915. *A synopsis of the British Siphonaptera. *Ent. mon. Mag.* **51:** 49–112; pls. vii–xiv.

SALMON, H. M. 1931. *The Manx Shearwater's flea. *Brit. Birds*, London, **25:** 171.

SHIPLEY, A. E. 1909. *The ectoparasites of the Red Grouse (*Lagopus scoticus*). *Proc. zool. Soc. Lond.* 1909: 309–334, pls. 35–47.

*Skokholm Bird Observatory Reports for 1938, p. 5, and 1939, p. 10. (Siphonaptera determined by C. Oldroyd and G. B. Thompson.)

SLATER, H., 1925. **Proc. Somersetsh. Archaeol. Nat. Hist. Soc.* **70:** liv.

—— 1927. **Proc. Somersetsh. Archaeol. Nat. Hist. Soc.* **72:** lxviii.

SMIT, F. G. A. M. 1949. Monstrosities in Siphonaptera. *Tijdschr. Ent.* (1946), **90:** 35–42; figs. 1–2.

THOMPSON, G. B. 1937*a*. *The parasites of British birds and mammals. XII. On some parasites from the burrows of Puffins. *Ent. mon. Mag.* **73:** 87–88.

—— 1937*b*. *The parasites of British birds and mammals. XIII. Records of Siphonaptera bred from birds' nests. *Ent. mon. Mag.* **73:** 105–107.

—— 1937*c*. *The parasites of British birds and mammals. XV. Bird fleas and their hosts. *Ent. mon. Mag.* **73:** 137–142.

TURK, F. A. 1946. *The Siphonaptera of Cornwall and the Isles of Scilly with the description of a new subspecies. *Ent. mon. Mag.* **82:** 97–100; 1 fig.

VERDCOURT, B. 1945. *Records of Bedfordshire Siphonaptera. *Ent. mon. Mag.* **81:** 74.

*Victoria History of the County of Hertford, 1920: 170.

*Victoria History of the County of Oxford, 1939: 178.

WAGNER, J. 1929. Über neue palaearktische Floh-Arten (Aphaniptera). I. *Annu. Mus. zool. Akad. Leningrad*, **30:** 21–33; 13 figs.

—— 1930. *Katalog der palaearktischen Aphanipteren.* 55 pp. Wien.

WAHLGREN, E. 1903*a*. Aphanipterologische Notizen, nebst Beschreibung neuer Arten. *Ark. Zool.* **1:** 181–196; pls. 7–9.

—— 1903*b*. Über *Pulex vagabunda* Bohem. *Ent. Tidskr.* **24:** 219.

—— 1907. Svenska Siphonaptera. *Ent. Tidskr.* **28:** 85–91; figs. 1–2.

WALSH, G. B. 1938. *A further contribution to a list of Yorkshire Siphonaptera. *Naturalist, Lond.* **977:** 185–187.

WATERSTON, J. 1906. *On some Scottish Siphonaptera. *Ann. Scot. Nat. Hist.*: 211–214.

—— 1909. *On some Scottish Siphonaptera. *Ann. Scot. Nat. Hist.* **18:** 226–228.

—— 1910. *On some habits and hosts of bird Ceratophylli taken in Scotland in 1909, with description of a new species (*C. rothschildi*) and records of various Siphonaptera. *Proc. R. phys. Soc. Edinb.* **18:** 73–91.

—— 1914. *Some records of Scottish Siphonaptera. *Ent. mon. Mag.* **50:** 88–91 and 159–166.

—— 1916. Fleas as a menace to man and domestic animals, their life-history, habits and control. *Brit. Mus.* (*Nat. Hist.*) *Econ. Ser.* **3:** 21 pp.; 6 figs.

—— 1923. *On the occurrence, near London, of the flea *Ceratophyllus vagabundus* Boh., under unusual circumstances. *Trans. Ent. Soc. Lond.* (1922), parts iii, iv: 454–460; figs. 1–2, 1 pl.

WILLIAMSON, K. 1940. *Numbers of Black Redstarts on passage in Man. *Brit. Birds*, **33** (9): 252–254.

* Papers containing records of British bird-fleas.

LIST OF TABLES

TABLE 1: Fleas collected by Colonel Richard Meinertzhagen and Miss Theresa Clay from the bodies of British birds.

TABLE 2: Records of *C. vagabunda* Boheman (1866).

TABLE 3: British bird hosts of *C. gallinae*, *C. garei*, and *D. g. gallinulae*.

TABLE 4: Comparative records of *C. gallinae*, *C. garei*, and *D. g. gallinulae* (compiled from all known British records).

TABLE 5: Selected hosts on which *C. garei* is the dominant species of flea.

TABLE 6: Selected hosts on which *C. gallinae* is the dominant species of flea.

TABLE 7: Selected hosts on which *D. g. gallinulae* is the dominant species of flea.

TABLE 8: British records of *C. gallinae*, *C. garei*, and *D. g. gallinulae* collected away from any host or nest.

TABLE 9: *C. gallinae*, *C. garei*, and *D. g. gallinulae* in the British Museum Collection from named bird hosts.

TABLE 10: Monthly records of *C. gallinae*, *C. garei*, and *D. g. gallinulae* from the bodies of bird hosts in Britain.

TABLE 11: Proportion of birds infested with fleas. (Collected by Colonel Meinertzhagen and Miss T. Clay.)

TABLE 12: Proportion of Great Tits (*Parus major newtoni*) infested with fleas. (Collected by Colonel Meinertzhagen and Miss T. Clay.)

BRITISH MUSEUM NATURAL HISTORY

PRESENTED

7 FEB 1952

PRINTED IN
GREAT BRITAIN
AT THE
UNIVERSITY PRESS
OXFORD
BY
CHARLES BATEY
PRINTER
TO THE
UNIVERSITY

17 APR 1952

THE SUB-GENUS *STEGOMYIA* (DIPTERA : CULICIDAE) IN THE ETHIOPIAN REGION

(PART I)

P. F. MATTINGLY

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 2 No. 5
LONDON : 1952

THE SUB-GENUS *STEGOMYIA* (DIPTERA : CULICIDAE) IN THE ETHIOPIAN REGION

I. A PRELIMINARY STUDY OF THE DISTRIBUTION OF SPECIES OCCURRING IN THE WEST AFRICAN SUB-REGION WITH NOTES ON TAXONOMY AND BIONOMICS

BY

P. F. MATTINGLY

Pp. 233–304; 16 *Text-figures*

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. 2 No. 5
LONDON : 1952

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in 1949, is issued in five series, corresponding to the Departments of the Museum.*

Parts appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. 2, No. 5 of the Entomology series.

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued April 1952 *Price Fifteen Shillings.*

THE SUB-GENUS *STEGOMYIA* (DIPTERA, CULICIDAE) IN THE ETHIOPIAN REGION

I. A PRELIMINARY STUDY OF THE DISTRIBUTION OF SPECIES OCCURRING IN THE WEST AFRICAN SUB-REGION WITH NOTES ON TAXONOMY AND BIONOMICS

By P. F. MATTINGLY

CONTENTS

INTRODUCTION 235
NOTES ON TAXONOMY 238
  Key to adults 244
  Key to larvae 247
DISTRIBUTION RECORDS 249
  Doubtful records 257
  Records based on misidentifications . . . 258
  Unidentified and misquoted localities . . . 258
  Distribution outside the Ethiopian Region . . 259
LIST OF LOCALITIES WITH TOPOGRAPHICAL DETAILS . 259
BIONOMICS IN RELATION TO DISTRIBUTION . . . 269
  Breeding-places 269
  Seasonal distribution 271
  Biting-habits 275
ZOOGEOGRAPHY 277
SUMMARY 293
ACKNOWLEDGEMENTS 294
REFERENCES 295
APPENDIX 303

SYNOPSIS

This paper deals with the distribution of the species of *Stegomyia* occurring in the West African sub-region. All the species of wide distribution in the Ethiopian Region are, however, included and the topographical data therefore cover most of the region. *Aëdes aegypti* is treated very briefly since it is regarded as a special case meriting a separate paper. Zoogeography is discussed mainly in relation to rainfall and altitude. Temperature and vegetational relationships will be discussed in later papers. Such notes on taxonomy and bionomics are included as appear to be necessary for an understanding of distribution. These also will be discussed at greater length in later papers in the series.

INTRODUCTION

THE objects of the present study are firstly to render possible a more rational approach to the taxonomy of the sub-genus *Stegomyia,* and incidentally of other African insects, and secondly to discover what light may be thrown by this comparatively well-known group on general problems concerning the distribution of the Ethiopian fauna. It is perhaps not too much to hope that some small quota may be added to the growing accumulation of evidence regarding past climates in Africa which is of fundamental importance for the understanding of phylogeny and of the human, plant, and animal geography of the continent.[1] Ernst Mayr (1942) has clearly shown that it is as a population that the species is encountered in nature, and it is upon population studies that our knowledge must ultimately be based. A taxonomy based solely on the arbitrary selection of morphological types, while indisputably essential, can only be of ancillary importance. In the author's opinion the greatest need for mosquito studies at the present time is the application of genetical methods (on this point see Bates, 1949).

The upper limit to our knowledge of distribution is imposed by the supply of collectors. In the present instance records are available from more than 600 localities (Fig. 1), but not all of these have been investigated with equal thoroughness. In general the British territories have rendered the best service, but it is unhappily true that the most serious gap in our knowledge at the present time is provided by Tanganyika, of which only a narrow fringe along the northern border and along the coast is known. Vast areas of unknown territory exist in Angola, the Cape Province, and French Equatorial Africa, but these are so situated that discoveries there would be likely to add to rather than to integrate our existing knowledge. From the phylogenetic point of view most knowledge could probably be gained from the study of high-altitude faunas. At present only those of Ruwenzori, the Kigezi district, and a few parts of Kenya are known.

The present paper deals only with those species occurring in the West African sub-region. Those which are known only from the East and South African sub-regions will be dealt with in a later communication. This does not mean that only the West African districts are considered. All the *Stegomyia* species of wide distribution in Africa enter this sub-region, and these species must necessarily be considered in relation to their range as a whole if their distribution is to be understood. The distribution of one species, *Aëdes aegypti*, is so artificial and so many records are available that to deal with these in full, as has been done for the other species, would serve little useful purpose, besides taking up a wholly disproportionate amount of space. Details of the distribution of this species may be found in Kumm (1931*b*) supplemented by Edwards (1941) and by the notes on recent records given below. Some small attention is paid, in the section on breeding-places, to the occurrence of wild populations. It is possible that some idea of the natural distribution of the species, which is almost certainly Ethiopian in origin, might be gained if more records of this kind were available.

Apart from one or two important collections which the author has not as yet had the opportunity to examine, all known sources of distribution records have been tapped. It is not believed that the collections in question will add to any great extent to our knowledge, as much of the material which they contain has been published. Great difficulty has been experienced in tracing many localities and in ascertaining the known facts regarding their climate and topography. In order to save others this labour the best available data have been included in tabular form. The major factors affecting distribution may be considered to be rainfall, temperature, humidity, and vegetation. The last named is itself dependent to so large an extent on the other factors that it is preferred to discuss it separately in a later communication. It is here referred to only where, as in the case of the Guinean forests, it appears to constitute a gross physical barrier to distribution. Attention has been paid to the possible influence of human transportation, but this is considered to be only a minor factor. Its importance for the mosquitoes is very liable to exaggeration and only the merest handful of species can be shown ever to have become established outside their natural boundaries, while very striking cases of failure to become established even under apparently favourable conditions can be quoted. Among the species here discussed only the domestic *Aëdes aegypti*, and *Aëdes simpsoni* which commonly breeds in the leaf axils of food plants, show any sign of having been affected in this way. Man as a destroyer of forests is perhaps more important, but this factor has relatively little significance for the present study, which is concerned rather with distribution at the present time and the factors by which this is controlled than with distribution in the past. The consideration of temperature and humidity has had to

---

[1] For a summary of this work see Zeuner (1944).

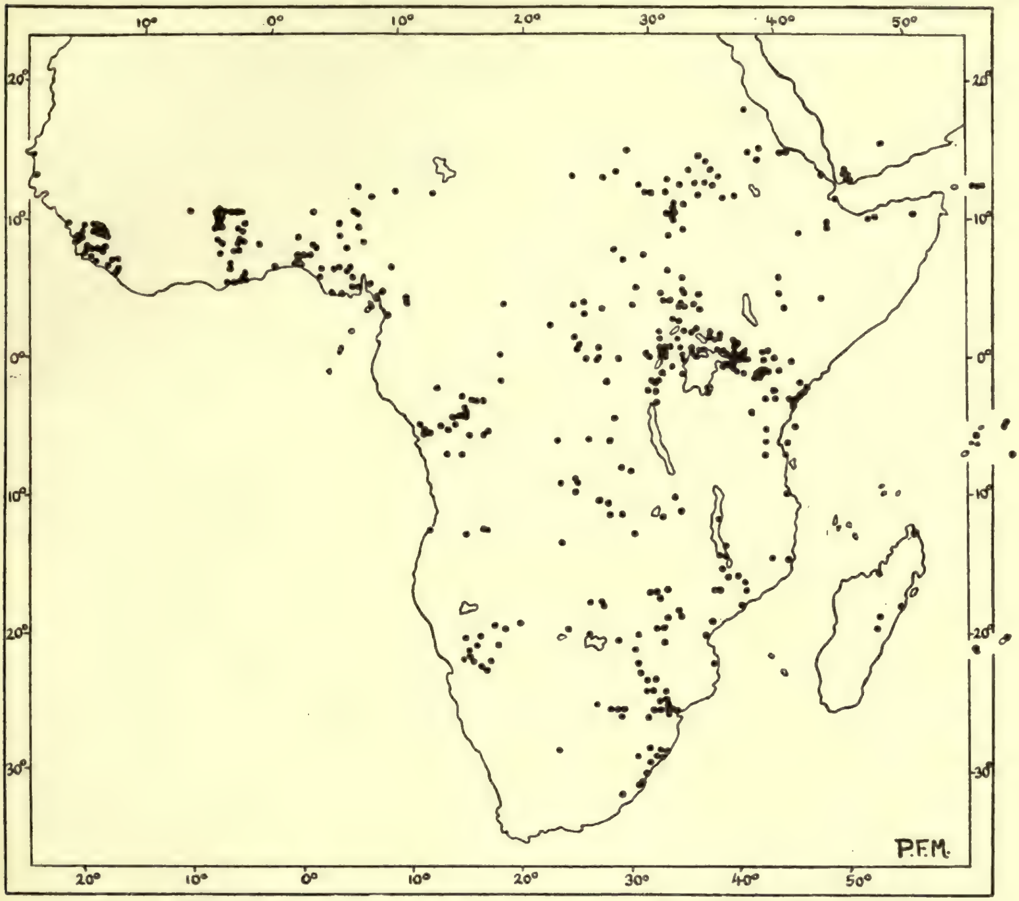


FIG. 1. Distribution of collectors of *Stegomyia* spp. other than *Aëdes aegypti*.

be postponed for a subsequent communication owing to the relative inaccessibility of the necessary data, but altitude is considered for the sake of the light which it throws on temperature limits. Rainfall, for which quite abundant figures have recently become available, is considered in full, and rainfall boundaries are found to provide a surprisingly, in some cases almost dramatically, accurate fit with known *Stegomyia* distributions, especially when the seasonal distribution of rain is taken into account. It must, however, be emphasized that the observations here recorded are purely empirical. It is not claimed that rainfall *per se* governs distribution. On the contrary, such evidence as is available suggests that for the most part it operates indirectly through its influence on vegetation.

Detailed taxonomic study of the sub-genus is in progress and is not yet complete. The treatment here adopted is therefore largely conventional except as regards *dendrophilus*, which has been the subject of much confusion. Work already carried out has, however, revealed a considerable number of errors in published descriptions, and these are corrected in the notes on taxonomy. The keys to adults and larvae cover all Ethiopian members of the sub-genus and have been made as up-to-date as possible. No descriptions of new species are at present known to be in the press, but the position of a new form from the East African Highlands is under consideration and will be discussed in the second paper.

The section on bionomics is confined to those aspects of the subject having an obvious and immediate bearing on distribution. In this connexion it may be said that the most serious gap in our knowledge concerns seasonal distribution, the proper understanding or even the mere recording of which would illuminate every aspect of mosquito studies.

NOTES ON TAXONOMY

Edwards (1932) divided the sub-genus *Stegomyia* into four groups. Of these, group A contains all the purely Ethiopian mainland species and the cosmotropical *Aëdes aegypti*. Group B contains certain Oriental and Palearctic species and *Aëdes mascarensis* of Mauritius. Group C contains Oriental and Australasian species and *Aëdes albopictus*, *granti*, and *unilineatus*, part of whose range is Ethiopian. Group D contains only *Aëdes vittatus*, which is Palearctic, Oriental, and Ethiopian, and shows certain characters anectant to the sub-genus *Aëdimorphus*. In so far as this grouping was based on the male terminalia it appears to have been a good one, but colour characters in *Aëdes* are somewhat unsatisfactory and *mascarensis* should perhaps have been placed in group A. In any case a new system of grouping has been rendered necessary by the discovery of *Aëdes amaltheus* (De Meillon & Lavoipierre, 1944), which is anectant between groups A and B, having the colour characters of one and the male terminalia of the other, the discovery of certain aberrant species of *Stegomyia* in the Mariana Islands (Bohart & Ingram, 1948), and the proposed transfer to this sub-genus of certain species hitherto assigned to *Armigeres* (Brug & Bonne-Wepster, 1947). Such a regrouping is, however, beyond the scope of the present paper, and the following notes refer only to matters of detail.

Aëdes apicoargenteus. Specimens from Kampala have a number of pale scales on the lateral lobes of the scutellum. Edwards (1941) states that in the 'typical form' these lobes are entirely black-scaled but gives no further explanation. This has led to some confusion. Other specimens with the lateral lobes white-scaled are recorded from Kenya (Van Someren, 1946), and Wolfs (1949) notes that they are white-scaled in ssp. *denderensis* from Costermansville. This is a rather unstable species, perhaps of comparatively recent origin, and the occurrence of this type of peripheral variation does not seem to have much taxonomic significance. It is, however, noteworthy that pale scaling has only been recorded from the higher parts of the range, above 3,000 ft. As will be shown below, *apicoargenteus* seems to be more strictly confined to low altitudes than, for example, *africanus*, whose range is otherwise similar. Its highland counterpart, *schwetzi*, has white lateral lobes. The occurrence of pale scales on the lateral lobes in *apicoargenteus* unfortunately renders separation from *fraseri* rather more difficult since this species frequently exhibits a number of dark scales in this position (see below). The extent of the pale area on the posterior surface of the hind femur is used by Edwards (1941) as a key character, but this is so variable in different parts of the range as to be extremely unreliable. The best diagnostic character from *fraseri*, as pointed out by Van Someren (1946), is the metallic sheen on the pale markings of the femora; *schwetzi* is easily separated by the very extensive pale scaling in the pre-scutellar region, but the differences in the male terminalia given by Edwards (1941) do not appear to be significant. The twisting of the style observed in *schwetzi* is due merely to the angle from which this was drawn and *apicoargenteus* also shows it when drawn from the same angle. The number and length of the bristles on the basal lobe is very variable in *apicoargenteus* and overlaps with that found in *schwetzi*. An average figure would perhaps be 8, but some specimens may have as many as 12. West coast specimens sometimes have fewer bristles than those from farther East, but the difference is not constant. The only genitalic character which seems to be of much diagnostic value concerns the IXth tergite, which is rather more deeply excavated in *schwetzi*, but even here there is some variation in both species. It is rather doubtful whether *schwetzi* should be treated as more than a sub-species, but further material is required from intermediate localities before the point can be settled.

The larvae of *apicoargenteus*, *fraseri*, and *schwetzi* are all very similar and closely resemble those of the East African *calceatus*, *soleatus*, and *langata*. As far as can be ascertained from available material, *apicoargenteus* and *fraseri* can generally be separated from the other species on the position of the antennal bristle. In *fraseri* this arises at 0·82–0·85 × the distance from base to apex of the antenna. In *apicoargenteus* the corresponding figure is 0·67–0·82. Specimens of this species from Uganda show a rather greater average displacement from the base than do those from Nigeria, Cameroons, and Belgian Congo, and this may be an altitudinal effect comparable to that described in connexion with the scutellar lobes. Average positions in material so far available are 0·80 for Uganda, 0·74 for Nigeria, and 0·75 for Belgian Congo and Cameroons, but the samples are too small for proper statistical analysis. In all specimens of the *calceatus* group examined the figure is less than 0·70. *schwetzi* overlaps the two groups. As noted by Van Someren (1946), those larvae of *fraseri* so far examined can be separated from *apicoargenteus* by the greater reduction of the median denticle of the comb spines (with proportional emphasis of the lateral fringe), but all specimens so far available come from Kenya and it is by no means certain that this character would be diagnostic for West Coast larvae. From all other members of the group, except ssp. *denderensis*, *calceatus* can be separated by the possession of a wholly dark siphon. This character is not mentioned in the type description of *denderensis* (Wolfs, 1949), but it is shown by both larvae available for examination and is very probably constant. It is a striking character, and although the differences from the type form with respect to male terminalia given in the type description are not constant, it is considered that this form should be named as a sub-species. Further material from the Kivu Highlands and Ruanda-Urundi would, however, be very welcome. Differences in colour characters between the sub-species and West Coast specimens of the type form include smaller anterolateral scutal patches, more frequent occurrence of pale scaling on the lateral lobes of the scutellum, narrower pale bands on third hind tarsi, and reduced pale scaling of fifth hind tarsi. None of these are, however, absolutely diagnostic from Kenya and Uganda specimens of the type form.

Aëdes fraseri. This species has already been discussed, but a further word is perhaps necessary regarding the scaling of the lateral lobes of the scutellum. Edwards (1941) states that the scales in this position are 'always white', a statement belied by his figure (Fig. 39). In fact some dark scales are usually present. It is probable that West Coast *apicoargenteus* can be reliably distinguished from *fraseri* by having the lateral lobes wholly or very largely black, but the distinction does not hold good in the eastern part of their range. As noted by Edwards (1941) and Van Someren (1946), the shape of the anterolateral pale scutal patches and the extent of the pale area on the posterior surface of the hind femur are subject to much variation.

Aëdes dendrophilus. This species has been misidentified by Van Someren (1946) and others by reason of the misleading description given by Edwards (1941). This description should be ignored and that given by Van Someren (loc. cit.) substituted for it. Edwards appears to have been misled by the very striking sexual dimorphism occurring in *dendrophilus*. This is an unusual phenomenon in *Stegomyia*, although a small degree of dimorphism with respect to, for example, the abdominal tergites is common. An even greater degree of dimorphism characterizes some oriental *Finlaya*, however (see photographs in Barraud, 1934). The characteristic markings of the male as described by Van Someren for the Kenya and Uganda forms are also shown by the Gold Coast form, and Edwards's type ♂, although damaged, shows them well. By reason of the same error of observation Edwards failed to recognize the identity of *dendrophilus* with *Aëdes trinidad*. Through the kindess of Dr. Ceballos and Dr. Peris of the Madrid Museum it has been possible to examine the two cotype males of this species and it is clearly conspecific with *dendrophilus*. It should be noted that the white spot on the clypeus referred to in the type description of *trinidad* (Gil Collado, 1935) is due to frosting of the integument and not to the presence of scales. *Aëdes aegypti* thus remains distinguishable from all other *Stegomyia* by the presence of scales in this position. A careful comparative study reveals that Edwards's type series of *Aëdes demeilloni* from Eshowe, Zululand, contains a specimen of *dendrophilus* which can be recognized by the character given in the key. The correctness of this diagnosis was suggested by the fact that the specimen in question was bred out from a tree-hole, whereas all those of *demeilloni* came from axils of *Dracaena* or 'Fern Tree'. Both the identity of the Eshowe specimen with *dendrophilus* and the distinctiveness of the breeding-places of the two species have been confirmed by the receipt of further specimens of both sexes kindly sent by Dr. De Meillon, and Mr. Muspratt has made extensive collections of both in Natal which add further confirmation. This curious but by no means unique distribution is discussed more fully in the appropriate section. The Kenya–Uganda, Sierra Leone–Gold Coast–Nigeria, Fernando Po, and South African forms all show minor differences in colour markings, and the latter at least should perhaps be named as a sub-species. The point will be discussed in a later paper to be devoted to taxonomy. The problem is complicated by the fact that Edwards's type series of *dendrophilus* consists of a number of dwarfed specimens, some with slightly atypical markings. These have the appearance of specimens bred out in the laboratory on an inadequate larval diet. The presence of thickened, spine-like setae on the inner angle of the basal lobe of the male terminalia of *dendrophilus* is not sufficiently indicated either by Edwards's drawing or by his figure. Such spines are characteristic of a number of species in this group (*dendrophilus*, *deboeri*, *bambusae*, *heischi*, *demeilloni*, *keniensis*, *angustus*) which cannot safely be separated either by the degree of development of the spines or the shape of the lobe, both of which are very variable. The larva of *Aëdes deboeri* is not constantly separable from that of *dendrophilus*. Kenya and Uganda specimens of the latter commonly have the sub-ventral seta of the siphon single (usually double in *deboeri*), but it is frequently double in the Gold Coast form. The best partial character appears to be the possession of more than one pecten tooth beyond the subventral seta. This is of freqent occurrence in *deboeri* but has never been observed in *dendrophilus*. In *bambusae* the subventral seta is commonly bifid but may be single, and there may be either 1 or 2 pecten teeth beyond it.

Aëdes africanus. Edwards (1941) gives a number of striking colour differences between this species and *luteocephalus*. Most of these differences are, however, very inconstant and this has led Haddow and Mahaffy (1949) and others to suggest that the two forms are interbreeding sub-species. With this opinion the present author is in strong disagreement. An examination of a large series of both species from many parts of their joint range shows that the extent of the pale basal marking on the hind femur affords an absolutely constant diagnostic character. Even in the most extreme forms the difference is striking, and in almost the whole of the material it is so gross as to be easily detectable with the naked eye (Fig. 2). Of the other characters proposed by Edwards the most reliable is perhaps the extent of the antero-median silver stripe on the mesonotum. Unfortunately, however, too many of the available specimens are rubbed in this position to be certain on the point. A fairly reliable character is the extent of the pale scaling at base of the 4th hind tarsal. This nearly always forms a complete ring in *africanus*, but in a few specimens from peripheral parts of the range the ring is interrupted ventrally. In *luteocephalus* the whole segment is commonly dark, but a small basal pale spot may be present on the dorsal surface, and in some specimens from the West Nile Province of Uganda this is fairly extensive and resembles the rather narrow pale interrupted band sometimes found in *africanus*. The remaining characters are of local value only, although their totality, in the great majority of cases, renders identification both certain and easy. The larval characters proposed by Hopkins (1936) are very largely unreliable and should be ignored except where experience has shown them to be locally applicable.

Aëdes pseudoafricanus. The small difference from *africanus* with respect to scutal markings noted by Chwatt (1949) appears to be constant in all available specimens. The whole of these, however, come from the Lagos area, and it is by no means certain that the character would prove constant should the species be discovered elsewhere. All male specimens attributed to *africanus* in the British Museum collection have been dissected and these have yielded only a few *pseudoafricanus* from Yaba. The resemblance of the male terminalia to those of *fraseri* is striking but it is not absolute. The posterior edge of the IXth tergite, for example, is quite different in shape in the two species. The combination of colour characters resembling those of one species with male terminalia resembling those of another is not unique among the Ethiopian *Stegomyia*. It is also shown strikingly by *amaltheus* (De Meillon & Lavoipierre, 1944). In view of the very curious results of cross-breeding experiments between certain species of *Stegomyia*, such cases must necessarily carry a suggestion of naturally occurring hybridization, and this is lent some colour in the case of *pseudoafricanus* by the distribution of the species concerned. In the experiments concerned Toumanoff (1937, &c.) showed that hybrid offspring of *Aëdes aegypti* and *Aëdes albopictus* exhibit all the morphological characters of the female parent in whichever direction the cross is made. This was confirmed for the *aegypti* ♀ × *albopictus* ♂ cross by Hoang Tich Try (1937) and for the reverse cross by Downs and Baker (1949). The genetical and cytological background is obscure, although some light is thrown on the problem by the discovery that in the mosquitoes, or at least in those species so far examined, there is no differentiation of sex chromosomes (Sutton, 1942; Callan & Montalenti, 1947; White, 1949). Gilchrist & Haldane (1947) consider that sex in these insects is determined by a single dominant gene for male. Downs & Baker (1949) have suggested that the phenomenon is one of parthenogenesis following mechanical fertilization of the ovum. This would not, however, explain the very interesting observation made by Bonnet (1950) that hybrid offspring of *aegypti* ♀ × *albopictus* ♂, although themselves identical

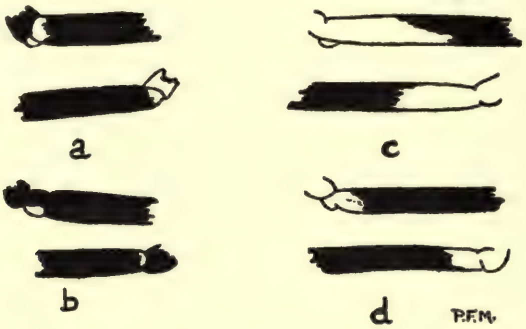


FIG. 2. Left hind-femur. *a–b. Aëdes africanus*; *c–d. Aëdes luteocephalus*. *a* from Ndola, *b* and *c* from Godia, *d* from Likoma Island. *d* is very exceptional.

with *aegypti*, produce offspring with *albopictus* characters when back-crossed to pure line *albopictus* ♂s. While these observations are of considerable interest in relation to the phylogeny of the sub-genus it is by no means certain that hybridization takes place in nature. Rozeboom and his fellow workers are of the opinion that it does not since females of *aegypti* and *albopictus* in cage colonies show an exclusive preference for males of their own species when given the choice, even though they may mate with males of the other species when no others are available (Mattingly *et al.*, in press). In the present author's opinion the most probable explanation of the occurrence of these intermediate forms is that they are genuinely anectant in the phylogenetic sense. The Lagos populations of *africanus* and *pseudoafricanus* are effectively sympatric at the present time, since, although the larval breeding-places are segregated, adults of both sexes of both species are taken together near the fringes of the mangrove swamps (Mattingly, 1949*b*). It does not, however, follow that this is a case of sympatric speciation. The area of low rainfall occurring between Lagos and Cape Three Points and serving to separate the Upper from the Lower Guinean forests is commonly supposed to result from a comparatively slight change in the direction of the coastline in relation to the direction of rain-bearing winds. If this is true, then small changes in the level either of the sea or of the land may well have served in the past to isolate extensive areas of mangrove 'forest' from the true forest with consequent speciation of mangrove and true forest *Stegomyia*, an interesting example of the possible effect of small changes of elevation on the climate, flora, and fauna.

Aēdes simpsoni. Haddow, Van Someren, *et al.* (in the press), note that this is a very variable species and express doubts as to the usefulness of applying the name 'var. *lilii*' to one among many varieties. It would seem, however, that the *simpsoni* of the Transvaal, Natal, and Cape Province may be largely isolated from those occurring in the rest of Africa (Fig. 12), and it is felt that if good representative collections could be assembled these would repay careful study. It is proposed to consider the matter from this angle in the course of the taxonomic work on the group. For a note on variation in this species see Edwards (1941).

Aēdes luteocephalus. This species has already been discussed under *africanus*. The type locality is wrongly quoted in the type description (see under 'Doubtful Records', p. 257).

Aēdes unilineatus. Difficulties experienced in identifying the larvae of this species (De Meillon & Lavoipierre, 1944; Lewis, 1945) were due in part to an error in the legend to Fig. 61 of the first volume of *Mosquitoes of the Ethiopian Region* (Hopkins, 1936). An examination of the original drawings for this figure and the specimens on which they were based shows that the comb and pecten spines attributed to *unilineatus* were in fact drawn from a specimen attributed by Ingram & De Meillon (1929) to *pseudonigeria* and reassigned by Edwards (1936) to *demeilloni*. The identity of this specimen is still uncertain, but it is certainly not *unilineatus*. The larva illustrated, in the same figure, as *demeilloni* is in fact *angustus*, and neither *demeilloni* nor *unilineatus* is figured. Typical comb spines of *unilineatus* have very small secondary denticles which are almost or quite invisible under low powers of the microscope. An occasional spine may have one or two large denticles, but such spines are clearly aberrant and should cause no difficulty. An extreme example is shown in Fig. 3

together with a normal comb spine. The pecten spines are very variable. The larva of *unilineatus* is very distinctive and should not be confused with any other occurring on the mainland. It can be recognized by the characters given in the key. The degree of development of the barred area of the ventral brush varies even in specimens from the same locality, but it is never as well developed as in the majority of species. Barraud (1934) notes that in Ethiopian *unilineatus* the saddle hair is usually 5-branched while in Indian larvae it is usually bifid. Such South African larvae as have been examined, however, show the bifid condition. Sudan and West Nile larvae have 4–5 branches, but Gold Coast larvae appear to produce either type of saddle hair at random. The descriptions of the male terminalia given by Edwards (1941) and Barraud (1934) are misleading since both appear to have overlooked the presence of two small, very strongly sclerotized setiferous lobes on the outer edges of the IXth tergite (Fig. 3). These are not shown in the only dissection left by Edwards in the British Museum owing to the way in which this is mounted, but they show clearly in fresh mounts from the same locality (Accra) and from Gadau, Erkowit, and Lahore.

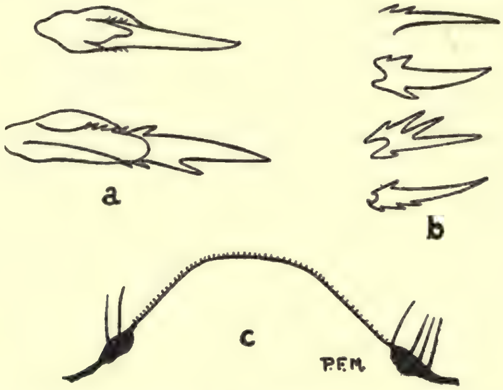


FIG. 3. *Aëdes unilineatus*. *a*. Comb spines. *b*. Pecten spines. *c*. IXth tergite of male. The lower comb spine is aberrant. This condition is only seen in an occasional spine.

KEY TO ADULTS

1. Scutum with 3 pairs of small white spots; tibiae white ringed near middle; proboscis usually pale in middle . . . . . . **vittatus** Bigot[1]
Scutum and tibiae otherwise; proboscis dark 2
2. Proboscis and tibiae with white lines . . . . . . *granti* Theobald
Proboscis all dark; tibiae dark except, in some cases, at base . . . 3
3. Front half of scutum white scaled . . . . *mascarensis* MacGregor
Scutum otherwise marked 4
4. Front half of scutum with a median white stripe only 5
Scutum otherwise marked 6

---

[1] Species dealt with in the present paper are shown in heavy type.

5. Middle femur with a white spot in middle in front . **unilineatus** Theobald
Middle femur without such a spot . . . . . *albopictus* Skuse
6. Middle femur with a white stripe in front reaching nearly to tip; clypeus of female scaly . . . . **aegypti** Linnaeus
Middle femur without such a stripe; clypeus bare 7
7. Third hind tarsal much more broadly pale than the others . . . 8
Third hind tarsal only narrowly pale 11
8. Hind femur with a well-marked pale patch at base broadly expanded below and behind (Fig. 2) . . . . . . **luteocephalus** Newstead
Hind femur at most with a small pale spot at base 9
9. Posterolateral lines of scutum broad, deep yellow, conspicuous, reaching forward almost or quite to the posterior ends of the anterolateral patches; thorax laterally compressed . . . . . . *ruwenzori* Haddow & E. C. C. Van Someren
These lines shorter, less conspicuous; thorax of normal width . . 10
10. Anterior median stripe of scutum very short; antero-lateral patches on scutum slightly crescentic, concave behind . . **africanus** Theobald
This stripe longer; scutal patches wedge-shaped, straight-edged behind . **pseudoafricanus** Chwatt
11. Fourth hind tarsal segment all black 12
Fourth hind tarsal segment pale at least at base 14
12. Lateral lobes of scutellum white scaled; anterior median spot on scutum composed of broad or narrow scales 13
Lateral lobes of scutellum dark scaled; this spot composed of narrow scales only . . . . *woodi* Edwards
13. Hind tibia all dark below . . . . **simpsoni** Theobald
Hind tibia extensively pale below at base . . . *strelitziae* Muspratt
14. Prescutellar area of scutum covered with broad metallic scales **metallicus** Edwards
This area with narrow, non-metallic scales 15
15. Posterior half of scutum with pale scales forming three or four narrow longitudinal lines 16
Posterior half of scutum with pale scales not aggregated into lines *chaussieri* Edwards
16. Median area of scutum with paired yellow longitudinal lines inside the usual posterolateral lines 17
This area with a single median line 18
17. Fourth hind tarsal segment white at base only . . *subargenteus* Edwards
This segment all white . . . *subargenteus* ssp. *kivuensis* Edwards
18. Each tibia with a narrow pale ring slightly removed from base *pseudonigeria* Theobald
White marks on tibiae confined to extreme base (except sometimes on the hind leg) 19
19. Hind tibia all dark (occasionally with a very small number of pale scales at base below in *keniensis*) 20

Hind tibia with a well-marked pale patch at base, at least on the under surface 22

20. Third hind tarsal pale all round on at least the basal $\frac{1}{7}$th *keniensis* E. C. C. Van Someren

Third hind tarsal all dark or, at most, with one or two pale scales at base below 21

21. Median longitudinal line of scutum white; prescutellar bare patch with a conspicuous border of pale scales . *amaltheus* De Meillon & Lavoipierre

Median longitudinal line yellow; pale scales round prescutellar bare patch reduced or absent . . . . *masseyi* Edwards

22. Pale basal patch on 6th abdominal tergite prolonged backwards nearly to the apex of the segment 23

This patch shallower, at most half the depth of the segment 26

23. First mid-tarsal pale behind nearly to the tip, pale in front on only about the basal $\frac{1}{5}$th . . . . *soleatus* Edwards

This segment pale above on at most the basal $\frac{3}{5}$ths, usually much less, more narrowly pale below, without any noticeable extension of pale scaling behind 24

24. Pale markings of femora snowy white . . . . . **fraseri** Edwards

These markings metallic silver 25

25. Prescutellar bare patch with a broad border of yellow scales; 5th hind tarsal entirely dark . . . . *schwetzi* Edwards

Prescutellar bare patch with at most a very narrow border of pale scales; 5th hind tarsal at least narrowly pale at base above (except sometimes in ssp. *denderensis*) . . . . **apicoargenteus** Theobald

26. First mid-tarsal segment pale behind for most of its length 27

This segment more or less uniformly ringed at base, without any noticeable extension of pale scaling on the posterior surface 28

27. 5th hind tarsal entirely dark . . . . . . *calceatus* Edwards

5th hind tarsal pale at base . . *heischi* E. C. C. Van Someren (in part)

28. Hind femoral knee-spot suppressed, represented by at most two or three pale scales; mid-femoral knee-spot, where present, at most very small, not reaching to the tip of the femur 29

Hind femoral knee-spot well developed; mid-femoral knee-spot reaching to the tip of the femur above 30

29. Thorax laterally compressed; mid-femur nearly always with a white spot on the anterior surface at about half-way between base and apex *angustus* Edwards

Thorax of normal width; mid-femur without such a spot *bambusae* Edwards

30. Mid-femur with a conspicuous white spot on the anterior surface at about two-thirds the distance from the base; 5th hind tarsal dark . . . 31

Either with the anterior surface of the mid-femur dark except for the knee-spot or with the 5th hind tarsal pale at base or both 33

31. Middle tibia pale below on at least the basal $\frac{1}{6}$th . . . *poweri* Theobald

Middle tibia usually all dark, at most with a small pale spot at base . 32

32. Hind tibia pale below on at least the basal $\frac{3}{10}$ths, this pale stripe expanded distally; median longitudinal pale line of scutum expanded in front of prescutellar bare patch and fused with the pale border round this patch; posterolateral lines of scutum yellow; second mid-tarsal pale above on at least a half, usually more . . . . *langata* E. C. C. Van Someren

Hind tibia pale on at most $\frac{1}{4}$, the pale stripe at most very slightly expanded distally; median pale line of scutum of uniform width throughout, not fused with the pale scales at the sides of the prescutellar bare patch; posterolateral lines usually white or whitish; second mid-tarsal pale above on at most $\frac{1}{2}$, usually less . . . . *contiguus* Edwards

33. Fifth hind tarsal largely dark, at most narrowly pale at base; anterior surface of mid-femur dark except for knee-spot . . *deboeri* Edwards

Fifth hind tarsal pale on at least the basal $\frac{1}{3}$rd, often more, or, if not, then anterior surface of mid-femur with a silvery spot at about $\frac{2}{3}$rds . . 34

34. Pale streak at base of hind tibia at most $\frac{1}{5}$th the tibial length, usually less; 2nd mid-tarsal broadly pale above on at most the basal half, apical half dark or at most with a very narrow dorsal line of pale scales . . 35

Either with the pale streak at the base of the hind tibia much more than $\frac{1}{5}$th the tibial length or with the 2nd mid-tarsal broadly pale above nearly to tip or both 36

35. Anterior surface of mid-femur usually with a spot of silvery scales *heischi* E. C. C. Van Someren (in part)

Anterior surface of mid-femur usually dark except at tip *demeilloni* Edwards

36. Anterolateral scutal patches pointed in front, varying in colour from bright yellow to creamy white; basal bands on abdominal tergites yellowish . . . . *bambusae* ssp. *kenyae* E. C. C. Van Someren

Anterolateral scutal patches rounded in front, snowy white; tergal bands white . . . . **dendrophilus** Edwards

KEY TO FOURTH-STAGE LARVAE

1. Ventral brush with at least the great majority of setae single . . 2

Ventral brush with at least the great majority of setae branched . . 5

2. Lateral seta of saddle and subventral seta of siphon single . . *angustus*

These setae each with at least 2 branches 3

3. Comb spines with a small number of well-developed lateral denticles, at least the submedian ones easily visible under low powers of the microscope; antennal seta with 2–4 branches . . . . *amaltheus* (in part)

Comb spines with the lateral denticles less strongly developed, invisible or visible only with difficulty under low powers of the microscope; antennal seta single 4

4. Barred area of ventral brush absent or poorly developed; saddle hair often with more than 2 branches . . . . *unilineatus*

Barred area of ventral brush well developed; saddle hair bifid . *albopictus*

5. Ventral brush with 2 or more isolated tufts arising proximal to the barred area 6

Ventral brush without unpaired tufts proximal to the barred area . . 7

6. Antenna lightly spiculate; setae of ventral brush with numerous branches; comb spines with lateral denticles only moderately developed . *vittatus*

Antenna smooth; setae of ventral brush single or bifid; comb spines with submedian teeth strongly developed, often appearing trifid *amaltheus* (in part)

7. Comb consisting of elongated scales fringed around the apex . *africanus, pseudoafricanus, luteocephalus*

Comb consisting of spines with the median denticle more strongly developed than the lateral denticles 8

8. Comb spines with a small number of rather coarse lateral denticles of which the submedian are usually visible under low powers 9

Comb spines with a fringe of more delicate denticles on either side of the main median denticle, these lateral denticles usually invisible under low powers and often almost invisible under high 19

9. Pecten spines very deeply cleft, typical spines with two or more large median denticles subequal in size; saddle hair and subventral seta of siphon single . . . . *subargenteus*

Pecten spines otherwise; saddle hair usually and subventral seta always with at least two branches 10

10. Pecten teeth with poorly developed secondary denticles invisible under low powers of the microscope 11

Pecten teeth with well-developed secondary denticles visible under low powers of the microscope 14

11. Lower caudal seta with 2 or more branches 12

Lower caudal seta single 13

12. Typical pecten teeth short and broad, not more than 4× as long as their breadth at base . . . . *simpsoni, demeilloni*

Typical pecten teeth longer and narrower, at least 6× as long as their breadth at base . . . . *strelitziae*

13. Spines at bases of pleural setae large and curved . . . . . *heischi*

These spines smaller . . . . *keniensis*

14. Distal edge of saddle with a group of coarse spicules near the base of the caudal setae, easily visible under low powers; antennal seta with 2–4 branches . . . . *amaltheus* (in part)

Distal edge of saddle smooth or at most with very minute spicules not or scarcely visible under low powers; antennal seta single 15

15. Saddle hair with at least 3 branches; pleural spines very large and conspicuous . . . . *metallicus*

Saddle hair with at most 2 branches; pleural spines smaller 16

16. Submedian denticles of comb spines strongly developed, giving the majority of these spines a trifid appearance under low powers . . 17

Submedian denticles not so strongly developed, only an occasional spine appearing trifid under low powers 18

17. Pecten with 8–12 spines . . . . *mascarensis*

Pecten with 14–20 spines . . . . *aegypti*

18. Upper caudal seta with about 6 branches; saddle hair with 3–4 . *granti*
    Upper caudal seta with 2–4 branches; saddle hair bifid . . . *contiguus*
19. Pecten spines arranged in discontinuous groups . . *bambusae kenyae*
    Pecten spines more or less equally spaced, at most with one or two terminal spines detached 20
20. Pecten spines with at least one secondary denticle near the base easily visible under low powers 21
    Pecten spines often almost simple, secondary denticles, when present, visible only under high power . . . *bambusae, dendrophilus, deboeri*
21. Siphon more or less uniformly dark 22
    Siphon dark only on about the basal $\frac{4}{5}$ths, apical $\frac{1}{5}$th pale . . . 23
22. Subventral seta of siphon with 3–4 branches; antennal seta situated at not more than $\frac{7}{10}$ths the distance from base to apex; saddle hair bifid or trifid . . . . *calceatus*
    Subventral seta of siphon bifid; antennal seta at more than $\frac{7}{10}$ths the distance from base; saddle hair single or bifid *apicoargenteus* ssp. *denderensis*
23. Median denticle of comb spines much reduced, lateral denticles well developed forming a fringe which is visible under low power . *fraseri*
    Median denticle strongly developed in relation to the fringe which is invisible under low power . . *apicoargenteus, schwetzi, langata, soleatus*

DISTRIBUTION RECORDS

The list which follows is believed to contain all published records except those which are merely repetitive and do not indicate that a species has been found more than once in a particular locality but merely that the same record has been published on more than one occasion. Doubtful records are marked with an asterisk and are discussed in a separate section. Records clearly based on misidentifications are omitted and are discussed in another section. Some of the records are based on unpublished specimens in various collections. For these collections the following abbreviations are employed. B.M. British Museum (Natural History); Berl. Berlin Museum; H.D. Hope Department, Oxford; H.I. Tropical Institute, Hamburg; L.S.H. London School of Hygiene and Tropical Medicine; Liv. Liverpool School of Tropical Medicine; M.L. Entomological Laboratory, Morogoro, Tanganyika. Records from the Washington Museum were kindly supplied by Dr. Stone. These are marked W.M. All references are listed in full in the bibliography. Addresses of correspondents who have sent records are given in the acknowledgements.

Aëdes apicoargenteus

Sierra Leone. Daru (Simpson, 1913; Evans, 1925), Batkanu, Koinadugu (Butler *et al.*, 1915), Mabang (Gordon, 1929), Moyamba, Pujehun (Davey, MS.). Liberia. Du River (Bequaert, 1930). Gold Coast. Kumasi, Obuasi (Theobald, 1909), Lorha (Carter, 1916), Nsawam (Macfie & Ingram, 1923*a*), Accra (Macfie & Ingram, 1923*b*), Aburi, Sunyani (Edwards, 1941), Asuboi (Mattingly, 1947). Togoland. Klein Popo (= Anecho, as *Aniella togoensis*, Enderlein, 1923). Nigeria. Lagos (Wesché, 1910;

Dunn, 1927*b*; Philip, 1931), Yaba (Graham, 1911; Dunn, 1926; Mattingly, 1947), Bende (Simpson, 1912*b*), Kaduna*, Katagum*, Zungeru* (Johnson, 1919), Aba, Ibadan, Ikeja (Mattingly, 1947), Itowolo (Mattingly, 1949*b*), Agbor (L.S.H.). Br. Cameroons. Misselele (Zumpt, 1937). Fr. Cameroons. Kribi or Wuri (as *Kingia maculoabdominalis*, Enderlein, 1923), Yaoundé (B.M.). Belgian Congo. Unnamed locality (as *Kingia albertii*, Theobald, 1912), Kayembe Mukulu (Rodhain & Bequaret, 1913), Kabinda (Edwards, 1926), Leopoldville (Duren, 1929), Stanleyville (Schwetz, 1930*a*; Liégeois, 1944), Lomami River between Obenge-Benge and Isangi (Schwetz, 1930*b*), Eala, Kisantu, Ponthierville (Edwards, 1941), Mongbwalu (Schwetz, 1944), Aba, Aketi, Ango, Basoko, Bayenga, Bondo, Buta, Irumu, Kimvula, Libenge, Niangara, Titule, Yangambi (Liégeois, 1944), Coquilhatville (Wolfs, 1946), Maluku, Nta, Pongwema (Fain & Henrard, 1948), Kimbao (Edwards, MS.), Luluabourg (B.M.), Katompe (Liv.). Ruanda-Urundi. Kisenyi* (Seydel, 1929*a*). Uganda. Unnamed locality (Neave, 1912), Entebbe (Bequaert, 1930), Kilembe (Edwards & Gibbins, 1939), Chagwe, Kampala (Edwards, 1941), Bundibugiyo (Haddow, 1945*a*), Bubukwanga (Haddow, 1945*b*), Mongiro (Smithburn & Haddow, 1946), Mamirimiri (Haddow, 1947), Zika (Entebbe area, Haddow & Dick, 1948), Budonga and Siba Forest, Bugala I., Bugoma Forest, Bujuko Forest, Busi I., East and West Busoga Woodlands (Jinja and Busia areas), Buvuma I., Bwamba Lowlands and North Spur Ruwenzori to 5,000 ft., Fort Portal, Itwara Forest, Kalinzu Forest, Kasyoha and Kitomi Forests, Kiansonzi, Kibale-Hima Forest, Kitgum, Kome I., Kyenjojo, Masaka, Masindi Port, Mubende, Mukono, Sango Bay Forests (Kaiso, Malambigambo, Namalala and Toro) (Haddow, in litt.), Mpumu, Namanve Payida (B.M.). Sudan. Khor Kobkwa (= Khor Kobwa, as *Kingia maculoabdominalis*, Theobald, 1913). Kenya. Kaimosi Forest, Kisii (Garnham *et al.*, 1946), Kakamega (E. C. C. Van Someren, 1946), Kabwoch, Sondu River (E. C. C. Van Someren, in litt.). Tanganyika. Bukoba (McHardy, 1932; Harris, 1942).

Aëdes fraseri

French Guinea. Dubreka (B.M.). Sierra Leone. Freetown (as *fraseri*, Bacot, 1916; as *fraseri* and *blacklocki*, Evans, 1926), Daru (as *blacklocki*, Evans, 1925), Njala (Edwards, 1941), Mabang, Moyamba Town (Liv.). Gold Coast. Takoradi (Edwards, 1941; Mattingly, 1947). Nigeria. Unnamed locality in the south (Edwards, 1917), Oshogbo (L.S.H.). Uganda. Unnamed locality (Neave, 1912), Mpumu (Edwards, 1912), Kampala (Hancock, 1930), Mamirimiri, Mongiro (Haddow, 1947), Bubukwanga (Smithburn *et al.*, 1949), Bukakata, Bwamba lowlands, and North Spur Ruwenzori to 5,000 ft., Bwigi I., Masindi Port (Haddow in litt.). Kenya. Kaimosi Forest, Kakamega (E. C. C. Van Someren, 1946), Sondu River (E. C. C. Van Someren in litt.).

Aëdes dendrophilus

Sierra Leone. Freetown (as *fraseri*, Edwards, 1917; as *dendrophilus*, Edwards, 1921*a*), Kissy (Liv.). Gold Coast. Aburi, Nsawam, Oblogo (Edwards, 1921*a*), Dodowah (Macfie & Ingram, 1923*b*). Nigeria. Lagos (Philip, 1931), Ibadan (Edwards, 1941). Fernando Po. Santa Isabel (as *trinidad*, Gil Collado, 1936).

UGANDA. Bwamba County (as *deboeri demeilloni*, E. C. C. Van Someren, 1946), Mongiro (as *deboeri demeilloni*, Smithburn & Haddow, 1946), Mamirimiri (as *deboeri demeilloni*, Haddow, 1947), Bubukwanga (Smithburn *et al.*, 1949), Bugoma Forest, Bujuko Forest, Busi I., Bwamba lowlands to 5,000 ft., Kitgum (*fide* Harper) (Haddow in litt.). KENYA. Kaimosi Forest (as *deboeri demeilloni*, E. C. C. Van Someren, 1946). ZULULAND. Eshowe (as *deboeri demeilloni*, Edwards, 1936). NATAL. Isipingo Beach, Margate (B.M.), Amanzimtoti (Muspratt in litt.). CAPE PROVINCE. Embotyi (Muspratt in litt.).

Aëdes africanus

FRENCH GUINEA. Kindia (Wilbert & Delorme, 1927). SIERRA LEONE. Freetown (Theobald, 1901; Evans, 1926; Davey, 1933), Koinadugu (Butler *et al.*, 1915), Daru (Evans, 1925), Mabang (Gordon, 1929), unnamed localities (Davey, 1939), Moyamba, Port Loko, Pujehun (Davey, MS.), Segbwema (Liv.), Bo (B.M.). LIBERIA. Kaka Town (Bequaert, 1930), Roberts Field, Kakata (Briscoe, 1947). GOLD COAST. Ashanti (Macfie & Ingram, 1916*b*), Tamale, Yape (Simpson, 1918), Broomassie* (Liv.). DAHOMEY. Bismarckburg (as *Aniella africana*, Enderlein, 1923). NIGERIA. Old Calabar (Theobald, 1901), Bonny, Duke Town (Theobald in Annett *et al.*, 1901), Lagos (Theobald, 1901; Wesché, 1910; Connal, 1916; Dalziel, 1920; Dunn, 1927*b*; Philip, 1931; Kerr, 1933), Oshogbo (Mayer, 1911), Yaba (Graham, 1911; Dalziel, 1920; Dunn, 1926; Philip, 1929; Mattingly, 1947), Bende, Forcados (Simpson, 1912*b*), Opobo (Connal, 1915), Afaka, Kaduna, Ubassa (Johnston, 1916), Brass, Ikom (Connal, 1917), Ikoyi (Dunn, 1926; Kerr, 1933), Ibadan (Kumm, 1931*a*; Kerr, 1933), Iwonran, Mushin (near Yaba, Kerr, 1933), Kateri (Edwards, 1941), Aba, Apapa, Ikeja (Mattingly, 1947), Itowolo (Mattingly, 1949*a*), Ogbomosho (Bugher *et al.*, in press), Sapele (L.S.H.). FR. CAMEROONS. Duala and unnamed localities (Grünberg, 1905), Yaoundé (B.M.). FR. EQUATORIAL AFRICA. Brazzaville (Sicé & Vaucel, 1928). BELGIAN CONGO. Ruwe (Theobald, 1907), Kabinda (Schwetz & Carter, 1915), Elisabethville, R. Vakila (Schwetz, 1927*a*), Stanleyville (Schwetz, 1927*b*; Liégeois, 1944), Tshela, Thysville (Schwetz, 1938), Coquilhatville, Lualaba River, Matadi (Edwards, 1941), Ilambi (Schwetz, 1942), Aba, Aketi, Bondo, Buta, Inongo, Irumu, Kimvula, Niangara, Titule, Yangambi, Yatolema (Liégeois, 1944), Balumi, Banningville, Black River, Dumi-Mato, Edudu, Pongwema, Tsunikitoko (Fain & Henrard, 1948), Costermansville, Lembwa River, Luluabourg (B.M.). RUANDA-URUNDI. Dendezi (B.M.). UGANDA. Kampala (as *Kingia africana*, Theobald, 1911*a*; as *Aëdes africanus*, Hancock, 1930), unnamed locality (= Chagwe, Mabira Forest, Neave, 1912), Bugomolo (Hancock, 1930), Kilembe (Edwards & Gibbins, 1939), Entebbe (Edwards, 1941; Haddow & Dick, 1948), Bundibugiyo (Haddow, 1945*a*), Bubukwanga (Haddow, 1945*b*), Mongiro (Smithburn & Haddow, 1946), Mamirimiri (Haddow, 1947), Kitinda, Zika (both near Entebbe, Smithburn *et al.*, 1948), Amagburugburu, Manjuguja North, Mbango (Smithburn *et al.*, 1949), Kyarumba (Haddow & Van Someren, 1950), Dwaji I. (Gillett in litt.), Budonga & Siba Forests, Bugala I., Bugoma Forest, Bujuko Forest, Bukasa I., Busi I., East and West Busoga Woodlands (Jinja and Busia areas), Buvuma I., Bwamba Lowlands, and North Spur Ruwenzori to 5,000 ft., Bwigi I., Fort Portal, Itwara Forest, Jana I., Kalinzu Forest, Kasyoha and Kitomi Forests, Kiansonzi, Kibale-Hima Forest, Kiryandongo, Kitgum, Kome I., Kyenjojo, Masaka, Masindi Port, Mityana, Mubende, Muhangi Forest, Mukono, Nyamugasani Valley, Sango Bay Forests (Kaiso, Malambigambo, Namalala and Toro) (Haddow in litt.), Godia, Kabarole, Kitasa, Midia, Payida (B.M.), Jinja, Mboga Stream (Jinja–Mumias Road) (Liv.). SUDAN. Li Rangu, Sopo (Lewis, 1945). ABYSSINIA. Sidamo Prov. (Bevan, 1937). KENYA. Chepalungu, Fort Ternan, Kaimosi Forest, Kisii (Garnham *et al.*, 1946), Kabwoch, Kakamega, Kibigori, Kisumu, Kitale, Koru, Lela, Maseno, Mugusi River, Muhuroni, Sondu River (E. C. C. Van Someren in litt.). TANGANYIKA. Bukoba (McHardy, 1932; Harris, 1942), Ukara I.* (B.M.). MOZAMBIQUE. Unnamed localities* (Howard, 1912). NYASALAND. Zomba* (Theobald, 1901). ANGOLA. Bihé (as *Stegomyia africana* and *Stegomyia dubia*), Katemar (= Katema's, Bihé area, as *S. dubia*) (Theobald, 1910), Kibokolo do Zombo (Gamble, 1912). N. RHODESIA. Ndola (Robinson, 1950).

Aëdes pseudoafricanus

NIGERIA. Yaba (as *africanus*, Graham, 1911), Lagos area (as *africanus*, Connal, 1915, &c.; Kerr, 1933; Edwards, 1941; as *pseudoafricanus*, Chwatt, 1949), Mushin (near Yaba, as *africanus*, Kerr, 1933), Itowolo (as *africanus*, Mattingly, 1949*a*), Ilado, Middle Point (both in Lagos area, Chwatt in litt.), Apapa, Gbohun–Gbohun, Ikoyi, Onigbongbo (Lagos area) (B.M.).

Aëdes simpsoni

GAMBIA. Bathurst (Edwards, 1941). SIERRA LEONE. Freetown (Kennan, 1915; Bacot, 1916; Evans, 1926), Daru (Blacklock, 1925), Kaballa (L.S.H.), Makeni, Port Loko, Pujehun (Davey, MS.). GOLD COAST. Dodowa (Simpson, 1914), Accra (Macfie, 1917), Takoradi (Pomeroy, 1932), Aburi (Edwards, 1941), Asuboi, Kumasi (Mattingly, 1947). NIGERIA. Afaka, Kudemsa (Johnston, 1916; Johnson, 1919), Yaba (Dunn, 1926; Philip, 1929; Mattingly, 1947), Ibadan (Philip, 1931; Kumm, 1931*a*; Kerr, 1933), Oshogbo, Shaki (Philip, 1931), Lagos (Kerr, 1933), Gadau (Taylor, 1934), Ikeja, Kaduna, Port Harcourt (Mattingly, 1947), Ogbomosho (Bugher *et al.*, in press). BR. CAMEROONS. Kumba (*fide* Macnamara), Babango (L.S.H.). FR. CAMEROONS. Yaoundé (B.M.). GABOON. Mayumba Forest (Galliard, 1931). BELGIAN CONGO. Kasongo, Tshumbiri, Wathen (Newstead *et al.*, 1907), Leopoldville (Newstead *et al.*, 1907; Duren, 1929), Matadi (Newstead *et al.*, 1907; Duren, 1938), Kivanda Kapepula (Rodhain & Bequaert, 1913), Kabinda (Schwetz & Carter, 1915), Stanleyville (Schwetz, 1927*b*; Liégeois, 1944), Katanga Prov. (Seydel, 1929*b*), Popokabaka (Schwetz, 1938), Karimi (as Karumi, Uganda, Edwards, 1941), shores of Lake Kivu (Schwetz, 1944), Costermansville (Schwetz, 1944; Wolfs in litt.), Aba, Aketi, Basoko, Bondo, Buta, Irumu, Kimvula, Niangara, Titule, Yangambi, Yatolema (Liégeois, 1944), Coquilhatville (Wolfs, 1946), Kingangati, Kwamouth (Fain & Henrard, 1948), Kimbao (Edwards in litt.). RUANDA-URUNDI. Usumbura (Edwards, 1941). UGANDA. Kampala (as *bromeliae*, Theobald, 1911*a*; as *simpsoni*, Hancock, 1930), unnamed locality (Neave, 1912), Kilembe (Edwards & Gibbins, 1939), Bundibugiyo (Haddow, 1945*a*), Bubukwanga (Haddow, 1945*b*), Bundinyama (Smithburn & Haddow, 1946), Soroti (Hopkins, MS.), Budongo and Siba Forests, Bugala I., Bugoma Forest, Bujuko Forest, Bukakara, Bukasi I., Busi I., East and West Busoga Woodlands (Jinja and Busia areas), Bwamba Lowlands and North Spur Ruwenzori to 5,000 ft., Entebbe, Fort Portal, Itwara Forest, Jubiya Forest, Kalinzu Forest, Kalungu, Kasyoha and Kitomi Forests, Kiansonzi, Kibale-Hima Forest (= Mpanga Forest auctt.), Kiryandongo, Kitgum, Kome I., Kyenjojo, Masaka, Masindi Port, Mityana, Mubende, Muhangi Forest, Mukono, Nyamugasani Valley to 5,000 ft., Sango Bay Forests (Kaiso, Malambigambo, Namalala, and Toro) (Haddowin litt.), Godia, Metu, Midia, Rumogi (B.M.). SUDAN. Bor (as *lilii*, Theobald, 1910), Khartoum* (Whitfield, 1939), Juba (Edwards, 1941), Kau (Findlay, Kirk, & MacCallum, 1941), Heiban, Kauda, Malakal, Meridi, Roseires, Sennar (Lewis, 1945), Torit (Knight in litt.). ABYSSINIA. L. Hardin (Edwards, 1941). ERITREA. Nefasit (Lewis, 1943*b*). KENYA Digo, Eldoret*, Kiambu*, Meru*, Nairobi* (Symes, 1935), Kisumu (Symes, 1935; Haddow, 1942), Kakamega, Kilifi (Symes, 1935; E. C. C. Van Someren in litt.). Mombasa (Symes & Roberts, 1937; Wiseman *et al.*, 1931; Teesdale, 1941), Fort Ternan, Kaimosi, Kisii (Garnham *et al.*, 1946), Gede (Bailey, 1947), Taveta (Heisch, 1948), Butere, Kerio Valley, Luanda, Makindu, Malindi, Msambweni, Tiwi, Yala (E. C. C. Van Someren, in litt.). TANGANYIKA. Unnamed locality (Neave, 1912), Dar-es-Salaam (Pomeroy, 1920; Edwards, 1923; McHardy, 1927; Harris, 1942), Lindi, Tanga (Haworth, 1924), Moshi (McHardy, 1932), Mtibwa Forest (Harris, 1942), Morogoro (Harris, 1942; Hocking, 1947), Amani (Berl.), Mwanza (M.L., E. C. C. Van Someren in litt.). PEMBA I. Unnamed locality (Edwards, 1941). ZANZIBAR. Various localities including Zanzibar Town (Aders, 1917*b*). MOZAMBIQUE. Mozambique, Nampula (De Meillon & Rebelo, 1941), Lourenço Marques, Umbeluzi (Rebelo & Pereira, 1943), Busi R., Guara Guara, Mambone, Nhemancone, Quelimane (W.M., *fide* Stone), Chindio (Liv.). NYASALAND. Unnamed locality (Neave, 1912), unnamed locality in uplands (Lamborn, 1930), Fort Johnston (Edwards, 1941), Fort Maguire, Likoma I. (L.S.H.). N. RHODESIA. Livingstone (Muspratt, 1945), Balovale (Robinson, 1948), Ndola (Robinson, 1950). ANGOLA. Bihé (Theobald, 1910), San Salvador (Gamble, 1914). S. RHODESIA. Shamva, Umtali (Leeson, 1931), Salisbury (Edwards, 1941), Bulawayo, Ndanga, Sinoia, Umtali, Victoria Falls (Meeser in litt.). TRANSVAAL. Unnamed locality (Theobald, 1905), Abundant in low veldt (Bostock & Simpson, 1905), Onderstepoort (Theobald, 1911*b*), Roberts Heights (Pratt-Johnson, 1921), Leysdorp Road, Nelspruit (Ingram & De Meillon, 1929). ZULULAND. Empangeni (Ingram & De Meillon, 1927), Mhlatuze, Ntabanana (Bedford, 1928). NATAL. Durban (Pratt-Johnson, 1921; Ingram & De Meillon, 1927; Bedford, 1928), Margate (Muspratt 1950), Amanzimtoti (Muspratt in litt.). BECHUANALAND. Kasane (De Meillon, 1947*a*). CAPE PROVINCE. Mkanduli (De Meillon & Lavoipierre, 1944).

Aēdes luteocephalus

GAMBIA. Bathurst (Edwards, 1941). FRENCH GUINEA. Dubreka (B.M.). SIERRA LEONE. Freetown (Bacot, 1916; Evans, 1926; Davey, 1933), unnamed localities (Davey, 1939), Bonthe, Makeni, Moyamba, Port Loko, Pujehun (Davey, MS.), Kissy (Liv.), Aberdeen (L.S.H.). LIBERIA. Roberts Field (Briscoe, 1947). GOLD COAST. Accra (Macfie & Ingram, 1916*a*), Ashanti (Macfie & Ingram, 1916*b*), Christiansborg (Accra area, Ingram & Macfie, 1917), Tamale, Yape (Simpson, 1918), Nsawam

(Macfie & Ingram, 1923*a*), Saltpond (Edwards, 1941), Aburi (B.M.). NIGERIA. Bende (Simpson, 1912*b*), Yaba (Simpson, 1912*b*; Dunn, 1926; Kerr, 1933; Mattingly, 1947), Lagos (Connal, 1915, &c.; Dalziel, 1920; Dunn, 1927*a*; Philip, 1931; Kerr, 1933), Adun (Connal, 1917), Ibi (Connal, 1924), Ikoyi (Lagos area, Dunn, 1926; Kerr, 1933), Oshogbo (Kumm, 1931*b*), Ibadan (Kumm, 1931*a*; Kerr, 1933; Mattingly, 1947), Iwonran, Kano, Mushin (near Yaba) (Kerr, 1933), Gadau (Taylor, 1934), Lokoja (Edwards, 1941), Ikeja (Mattingly, 1947), Ogbomosho (Bugher *et al.*, in press), Badagry (Liv.). BELGIAN CONGO. Kumba* (Newstead *et al.*, 1907), Jadotville (De Meillon, 1943), Kasongo (Liv.). UGANDA. Mpumu (as *Kingia luteocephala*, Theobald, 1910), unnamed locality (Neave, 1912), Mamirimiri (Haddow, Smithburn, *et al.*, 1948), Bwamba Lowlands and North Spur Ruwenzori to 5,000 ft. (Haddow in litt.), Godia, Laufori, Metu, Rumogi (B.M.). SUDAN. Bor (Theobald, 1910), Juba (Hewer, 1934; Edwards, 1941), Khartoum* (Whitfield, 1939), Heiban (Lewis, 1943*a*), Danaglia, Malakal, Sennar, Wad el Magdub (Lewis, 1945), Jebel Marra (Abbott, 1948), Singa (B.M.). ERITREA. Nefasit (Lewis, 1943*b*). KENYA. Fort Hall, Kerio Valley, Kisumu (E. C. C. Van Someren in litt.). N. RHODESIA. Balovale, Livingstone (Robinson, 1948), Ndola (B.M.). NYASALAND. Likoma I. (L.S.H.). S. RHODESIA. Victoria Falls (Meeser in litt.). BECHUANALAND. Kasane, Maun (De Meillon, 1947*a*).

Aëdes unilineatus

GOLD COAST. Accra (Macfie, 1916), Tamale* (Ingram, 1919), Aburi (Edwards, 1941). NIGERIA. Kaduna, Katagum, Zungeru (Johnson, 1919), Ibadan (Philip, 1931), Gadau (Taylor, 1934), Baro, Lokoja (Edwards, 1941), Ogbomosho (Bugher *et al.*, in press). UGANDA. Metu, Rumogi (B.M.). SUDAN. Bahr-el-Ghazal (Theobald, 1906), Jebelein (Theobald, 1910; Lewis, 1948), Erkowit, Juba (Edwards, 1941), Heiban (Lewis, 1943*a*), El Fasher, Jebel Moya, Sennar, Tembura, Wad el Magdub, Wad Medani (Lewis, 1945). KENYA. Unnamed locality (Neave, 1912), Dolo, Juba River (Edwards, 1941). NYASALAND. Port Herald (Edwards, 1941). N. RHODESIA. Livingstone (De Meillon & Lavoipierre, 1944). S. RHODESIA. Fort Victoria (De Meillon, 1943). TRANSVAAL. Letaba, Tzaneen (Ingram & De Meillon, 1929).

Aëdes metallicus

SENEGAL. Dakar (Kartman *et al.*, 1947). GOLD COAST. Accra (Macfie, 1916), Navarro (Ingram, 1919), Asuboi (Mattingly, 1947). NIGERIA. Kano (Kumm, 1931*a*), Gadau (Taylor, 1934), Maiduguri (Mattingly, 1947). BELGIAN CONGO. Jadotville (De Meillon, 1943). UGANDA. Mbarara (Edwards, 1941), Soroti (Haddow in litt.). SUDAN. Bor (as *dubia*, Theobald, 1910), Darfur Prov., Juba (Edwards, 1941), Nuba Mts., Wad el Magdub (Lewis *et al.*, 1942), Heiban (Lewis, 1943*a*), Abu Usher, Dagu, El Fasher, Kadugli, Kalora, Kassala, Khartoum, Kheiwok, Kudring, Malakal, Mug, Nahud, Raga, Roseires, Sennar, Shaloat, Sheikh Gamal, Sheikh Karim, Wad Banda, Wad Ganatir, Wad Medani (Lewis, 1945), Dueim, Kosti (Lewis, 1948), Yambio (Abbott in litt.), Umm Sunt (B.M.). KENYA. Mombasa (Wiseman *et al.*, 1939; Teesdale, 1941), Kisumu (Haddow, 1942), Fort Ternan (Garnham *et al.*, 1946), Isiolo (Heisch, 1947), Gede (Bailey, 1947), Garissa, Garsen, Gotani, Kakamega, Kerio Valley, Kibos, Kilifi, Kipini, Koru, Langata Forest, Makindu, Malindi, Maseno, Msambweni, Taveta, Witu (E. C. C. Van Someren in litt.). TANGANYIKA. Dar-es-Salaam (Edwards, 1923; Scott, 1926; McHardy, 1927), Tanga (Nixon, 1923; Haworth, 1924), Lindi (Haworth, 1924), Morogoro (Harris, 1942), 'Widely distributed from coast to Moshi and Mwanza' (Harris, 1942), Mwanza (M.L., E. C. C. Van Someren in litt.). ZANZIBAR. 'Various localities' (Aders, 1917*a*), Zanzibar Town (Aders, 1917*b*), Mnazi Moja (= European Club, Zanzibar Town, Edwards, 1941). MOZAMBIQUE. Nova Choupanga (Séguy, 1931). N. RHODESIA. Livingstone (De Meillon & Lavoipierre, 1944). ANGOLA. Bihé (as *Quasistegomyia dubia*, Theobald, 1910). S. RHODESIA. Bindura, Gatooma, Shamva (Leeson, 1931), Fort Victoria, Odzi, Salisbury (Meeser in litt.). TRANSVAAL. Komatipoort, Letaba (Ingram & De Meillon, 1929). ZULULAND. Mhlatuze, Ntabanana (Bedford, 1928). BECHUANALAND. Francistown, Kasane, Maun, Nata (De Meillon, 1947*a*). S. W. AFRICA. Fransfontein, Grootfontein, Karabib, Okahandja, Okimbahe, Omatjette, Otjimbingwe, Outjo, Usakos (Muspratt in litt.).

Aëdes vittatus

GAMBIA. Bathurst (Theobald, 1903). SIERRA LEONE. Freetown (Theobald, 1901; Butler *et al.*, 1915; Bacot, 1916; Evans, 1926; Davey, 1939), Batkanu, Benikoro, Firiwa, Kaballa, Serakolia, Sonkonia, Tirikoro, Waliki (Simpson, 1913), Koinadugu (Butler *et al.*, 1915), Daru (Edwards, 1941), Kamabai, Yiraia (B.M.), Boala Karafaia, Kamasiki (L.S.H.), Bo, Kailahun, Makeni, Moyamba, Port Loko (Davey, MS.), Dunkiawallia, Pujehun (Liv.). LIBERIA. Monrovia (Kumm, 1931*a*), Firestone Plantation (Du Group) (Barber *et al.*, 1932), Roberts Field (Briscoe, 1947). IVORY COAST. Bobo-Dioulasso (B.M.). GOLD COAST. Bole (Ingram, 1912), Cape Coast, Tamale (Simpson, 1914), Wa (Carter, 1916), Batiasan, Dogankade, Gambaga, Jefisi, Kulmasa, Lilixia, Mayoro, Nacon, Nandaw, Nandawli, Nangudi, Pinna, Sambolugu, Savelugu, Tanina, Tishi, Tumu, Ulu, Winduri, Yeji, Zouragu (Ingram, 1919), Sunyani (Edwards, 1941), Accra, Kintampo (Liv.). NIGERIA. Oshogbo (Mayer, 1911; Mattingly, 1947), Baro (Simpson, 1912*a*), Zungeru (Simpson, 1912*a*; Johnson, 1919), Lokoja (Connal, 1915), Kakuri (Johnston, 1916), Katagum (Johnson, 1919), Kaduna (Johnson, 1919, 1920), Gadau (Taylor, 1930), Abeokuta, Funtua, Ibi, Kano, Katsina, Shaki, Yola (Kumm, 1931*a*), Ibadan (Kumm, 1931*a*; Mattingly, 1947), Ikoyi (Kerr, 1933), Ogbomosho (Bugher *et al.*, in press). FR. CAMEROONS. Yaoundé (B.M.). BELGIAN CONGO. Kisui (as *sugens*, Newstead *et al.*, 1907), Leopoldville, Matadi (Newstead *et al.*, 1907; Duren, 1929), Elisabethville (Schwetz, 1927*a*), Stanleyville (Schwetz, 1927*b*, 1930*a*; Liégeois, 1944), Boma (Duren, 1929), Kinshasa (Bequaert, 1930), Lukula (Schwetz, 1938), Kaparata (Schwetz, 1944), Aba, Bondo, Buta, Libenge, Niangara, Titule (Liégeois, 1944), Coquilhatville* (as *sugens*, Wolfs, 1946). UGANDA. Entebbe (Theobald, 1907), unnamed locality (Neave, 1912), Sipi (Hancock & Soundy, 1929; Hargreaves, 1932), Kyere, Mukongoro (Hancock, 1930), Busi I., Fort Portal, Kitgum, Masindi Port, Soroti (Haddow in litt.), Ntotoro Valley (Lumsden in litt.), Buvuma I. (Gillett in litt.), Chagwe, Jinja, Metu, Rumogi (B.M.). SUDAN. Erkowit (Theobald 1910), Darfur Prov., Juba, Mongalla Prov. (Hewer, 1934), Nuba Mts. (Hewer, 1934; Lewis, 1943*a*), Malakal (Hewer, 1934; Lewis, 1945), Khartoum* (Bedford, 1938), Dar Shol, Delami, Kajo Kaji, Talodi (Edwards, 1941), Jebel Meidob (Edwards, 1941; Lewis, 1945), Jebelein (Edwards, 1941; Lewis, 1948), Wau (Edwards, 1941; Abbott in litt.), Damazin Cataract, Doka, El Obeid, Gedaref, Geneina, Jebel Gurein, Jebel Mandera, Kassala, Kosti*, Roseires, Sennar, Umm Ruaba (Lewis, 1945), El Fasher, Jebel Marra (Abbott, 1948), Rumbek, Yambio (Abbott in litt.), Loka (Liv.). ARABIA. Aden, Nobat (= Nobat Dakim), Sheikh Othaman, Ulub (Patton, 1905), Wadiyain (as Wadi Yain, Edwards, 1941), Jebel Jihaf (B.M.). SOKOTRA I. Hadibo, Kallansiya, Kathub (Leeson & Theodor, 1948). ABYSSINIA. Harrar (as *brumpti*, Neveu Lemaire, 1905), L. Metahara area* (as *Stegomyia* sp., Doreau, 1909), Meta Gafersa (La Face, 1939). ERITREA. Arisateb Valley, Tessenei, Ugaro (Lewis, 1943*b*), Ras Malalu, east slopes of central massif, western plains (Jannone *et al.*, 1946), Mt. Ramlu at 3,000–4,000 ft. (B.M.). BRITISH SOMALILAND. Buran (Edwards, 1941), Gedeis, Upper Sheikh (G. R. C. Van Someren, 1943), Las Anod (B.M.). KENYA. Shimoni (as *sugens*, Edwards, 1914), Digo, Kisumu, Meru (Symes, 1935), Mombasa (Symes, 1935; Wiseman *et al.*, 1939), Nairobi (Symes, 1935; H. I., *fide* Weyer, E. C. C. Van Someren in litt.), Fort Hall, Kakamega, Kilifi (Symes, 1935; E. C. C. Van Someren in litt.), Central Kavirondo (Symes & Roberts, 1938), 'Third Camp' (Edwards, 1941), Kaimosi Forest (Garnham *et al.*, 1946), Isiolo (Heisch, 1947), Kisumu (Grainger, 1947), Eldoret, Gotani, Kericho, Kiambu, Kisii, Kitale, Kitui, Langata, Makindu, Malindi, Mara R., Maragua, Maseno, Narok, Taveta, Thika, Turbo, Wesu (E. C. C. Van Someren in litt.), Malakisi (*fide* Leeson). TANGANYIKA. Lindi (Haworth, 1924), Morogoro (Scott, 1926; Harris, 1942), Mwanza (McHardy, 1932; Harris, 1942), 'Widely distributed from coast to Bukoba' (Harris, 1942), 'All along shores of Mwanza Gulf and on Ukara Island' (Smith in litt.), Dar-es-Salaam (B.M.). PEMBA I. Unnamed locality (Edwards, 1941). ZANZIBAR. Zanzibar Town (Aders, 1917*a*). MOZAMBIQUE. Unnamed localities (Howard, 1912), Mocuba, Quelimane (De Meillon & Rebelo, 1941), Namaacha (Rebelo & Pereira, 1943), Ressano Garcia (W. M., *fide* Stone). NYASALAND. Uplands (Lamborn, 1930), Fort Johnston (B.M.), 'Abundant above 3,000 ft.' (Lamborn, MS.). N. RHODESIA. Livingstone (Robinson, 1948). ANGOLA. Bihé (Theobald, 1910). S. RHODESIA. Mashonaland (Theobald, 1901), Gatooma, Salisbury, Shamva (Leeson, 1931), Bindura, Chibi, Mt. Darwin, Fort Victoria, Goromonzi, Gwelo, Maranka Reserve, Matopo Hills, Msoneddi, Ndanga, Triangle Estate, Umtali, Victoria Falls, Zaka (Meeser in litt.), Epworth (L.S.H.). TRANSVAAL. Onderstepoort (Theobald, 1911*b*; Bedford, 1928), Brits (Ingram & De Meillon, 1927), Yokeskei River (De Meillon, 1928), Komatipoort, Letaba, Louis Trichardt, Nelspruit, Skukuza, Tomango, Waterpoort, Waterval Boven (Ingram & De Meillon, 1929), Pietersburg (Liv.). ZULULAND, Begamuzi Drift (Ingram & De Meillon, 1927), Ntabanana (Bedford, 1928). NATAL. Weenen (Bedford, 1928), Margate (Muspratt in litt.). BECHUANALAND. Kasane (De Meillon, 1947*a*). S.W. AFRICA. Karabib, Okimbahe, Otjimbingwe, Outjo (Muspratt in litt.).

Aëdes aegypti

Apparently more or less throughout the region except at high altitudes and, perhaps, in the extreme south and south-west. The following records will be found to fill most of the gaps in the table given by Edwards (1941). CAPE PROVINCE. Grahamstown, Port St. Johns (Edwards, 1941), Kimberley (De Meillon, 1942), Upington (De Meillon, 1943). S.W. AFRICA. Tsumeb, Windhoek (De Meillon, 1943), Fransfontein, Karabib, Okimbahe (Muspratt in litt.). BECHUANALAND. Kasane, Nata (De Meillon, 1947*a*). N. RHODESIA. Balovale, Livingstone (Robinson, 1948), Ndola (Robinson, 1950). TANGANYIKA. 'Throughout' (Harris, 1942). SUDAN. Widespread in Darfur Province (Abbott, 1948).

DOUBTFUL RECORDS

Aëdes apicoargenteus

NIGERIA. Kaduna, Katagum, Zungeru. Johnson does not state from which of these localities his specimens came. Katagum seems much too dry. RUANDA-URUNDI. Kisenyi. No specimens are at present available for examination. In the distribution maps (Figs. 4 and 8) the record is ascribed to ssp. *denderensis*.

Aëdes africanus

GOLD COAST. Broomassie. The specimen in question is not marked with the locality but was contained in a box with other specimens similarly labelled and known to have come from Broomassie. There is nothing intrinsically unlikely about the record. TANGANYIKA. Ukara Island. This record is based on a single larva and requires confirmation. MOZAMBIQUE and NYASALAND. No specimens can now be found by means of which these interesting records could be confirmed or disproved. They are discussed below under zoogeography.

Aëdes simpsoni

SUDAN. Khartoum. This record is based on a single specimen found in an aeroplane and may be presumed to be the result of casual introduction. KENYA. Records given by Symes (1935) from localities above about 5,000 feet have not been confirmed and are thought to have been due to misidentification, although, in the absence of specimens, this cannot be proved.

Aëdes luteocephalus

BELGIAN CONGO. Kumba. In his type description Newstead states that a single specimen was taken at Kumba. This is clearly an error since the Liverpool School collection contains two cotypes both marked by Newstead on the actual mounts as taken at Kasongo. In his type description of *Aëdes* (*Dunnius*) *albomarginatus*, in the same paper, Newstead states that two specimens were taken at Kasongo, but the Liverpool collection contains only a single holotype marked as taken at Kumba. It is quite evident that Newstead confused the data relating to the two species in his published descriptions and that the type locality of *luteocephalus* is Kasongo. The point is of some importance since a record from Kumba would be entirely at variance with what is known of the distribution of this species, while Kasongo is perfectly acceptable. Edwards (1941) sought to equate Kumba with Tumba, but this appears to have been quite gratuitous. Kumba is, in fact, a small village whose position is clearly shown on Newstead's map (see also under misquoted localities *infra*). The reference by Theobald (1910) to a 'type ♂' of *luteocephalus* in the British Museum concerns a specimen of King's from the Sudan apparently chosen by Theobald as a lectallotype. SUDAN. Khartoum. This record is based on a single specimen found in a plane and may be taken to represent a casual introduction.

Aëdes unilineatus

Gold Coast. Tamale. This record was based on larvae only and is queried by Ingram. He was, however, familiar with the larva of *unilineatus* which he helped to describe (Ingram and Macfie, 1917) and the record seems perfectly acceptable.

Aëdes vittatus

Belgian Congo. Coquilhatville. Wolfs quotes this record from a report of the hygiene service at Coquilhatville for 1941. It is not supported by specimens and *vittatus* has not been found again in Coquilhatville. Sudan. Khartoum and Kosti. Lewis (1945) considers that these were chance introductions. Abyssinia. Lake Metahara area. The species in question is stated to have been found breeding in large numbers in rock-holes and it appears very probable that it was *vittatus* although its identity cannot now be established.

Records based on Misidentifications

The following records have been rejected.

Aëdes fraseri

Sierra Leone. Freetown (Edwards, 1917). = *dendrophilus* (see Edwards, 1921*a*). S. Rhodesia. Unnamed localities (Garnham *et al.*, 1946). = *langata.*

Aëdes africanus

N. Rhodesia. Unnamed locality (Edwards, 1912). = *chaussieri* from Lake Young area. S. Rhodesia. Mashonaland (Theobald, 1901). = *contiguus.*

Unidentified and Doubtful Localities

Sierra Leone. Dunkiawallia, Kamasiki, Waliki. Records of *Aëdes vittatus* from these localities are not thought to be of sufficient interest to merit an intensive search. It is evident that this species is widely distributed throughout the territory. Kumm (1931*b*) takes Waliki to be the name of a place, but from Simpson's account it seems equally possible that it is the name of a river.

Fr. Cameroons. Wuri (*A. apicoargenteus*). This is presumed to refer to some locality on the Wuri River, probably at or near Duala.

Belgian Congo. Kimba (*A. luteocephalus*, Theobald, 1910*a*) and Tumba (*A. luteocephalus*, Schwetz, 1927*b*). These are clearly inaccurate renderings of the type locality, Kumba, as given by Newstead *et al.* (1907) (for a further discussion see above under doubtful records). Lualaba River (*A. africanus*, Edwards, 1941). In its present form this record is too vague to be of any value. No specimens are at present available.

Kenya. 'Third Camp' (*A. vittatus*). The significance of this record could only be ascertained by reference to relevant correspondence or records. These are not available to the author. The specimen was collected by Dr. Chell in about 1913.

? Nyasaland. Zoruta (*A. africanus*, Theobald, 1910). This is presumed to be a misspelling of Zomba from which Theobald (1901) has a previous record.

Arabia. Wadi Yain (*A. vittatus*, Edwards, 1941). The correct rendering should be Wadiyain. Mr. Philby, who collected the specimens, kindly supplied this information together with the approximate map reference given below.

Distribution outside the Ethiopian Region

Aëdes unilineatus. Punjab, Delhi Prov., Bombay area (Barraud, 1934).

Aëdes vittatus. Corsica (Bigot, 1861, not since found there); Spain (Gil Collado, 1935; Clavero, 1946); India, Ceylon (Barraud, 1934); Cochin China, Annam (Borel, 1930); Algeria (Senevet, 1936).

Aëdes aegypti. Throughout tropics and sub-tropics (Barraud, 1928; Kumm, 1931*b*; Farner *et al.*, 1946; Brug & Bonne-Wepster, 1947).

LIST OF LOCALITIES WITH TOPOGRAPHICAL DETAILS

The list is as accurate as it has been possible to make it from readily available sources. It could undoubtedly be improved, especially by persons with local knowledge. Figures enclosed in brackets have been read from maps or, in the case of rainfall figures, refer to an adjacent station. In the case of regions or provinces an average figure is given and such figures are also enclosed in brackets. Where more than one rainfall station is available for a particular locality an average figure is given. Published figures and figures sent in litt. are unenclosed. Altitudes are given in feet, where possible to the nearest 100 ft., otherwise to the nearest 500 ft. Rainfall is given as the mean annual total to the nearest 5 inches and all references in the text should be read in this sense. For many of the data included in the table the author is indebted to correspondents. Aside from this the main sources have been Gossweiler & Mendonça (1939), Grandidier (1934), Hurst & Black (1943), Nash (1948), Vandenplas (1943), *The Times Gazetteer*, the Atlas Général du Congo Belge, the Atlas do Portugal Ultramarino, the Gold Coast Atlas, the Atlas of the Tanganyika Territory, the East and South African Handbooks, the Boletim Mensal das Observaçoes Meteorologicas (Lourenço Marques), the annual rainfall summaries of the British East African Meteorological Department, the climatological summaries of the Rhodesia and Nyasaland Meteorological Service, the summary of rainfall normals issued by the South African Department of Irrigation, and the handbooks and reports of various government departments. Finally, where no published figures were available, reference was made to the excellent large-scale maps of nearly every part of Africa prepared during the last war for use by the forces and now available to the public. Among these the Rainfall Map of Eastern Africa prepared by the East African Survey Group (E. A. F. No. 1518 of 1943) deserves special mention.

List of Localities

Locality	*Altitude*	*Latitude*	*Longitude*	*Rainfall*
Aba, Belgian Congo	(3,500)	3.50 N.	30.13 E.	(55)
Aba, Nigeria	< 500	5.07 N.	7.21 E.	85
Abeokuta, Nigeria	< 500	7.09 N.	3.21 E.	40
Aberdeen, Sierra Leone	< 500	8.30 N.	13.18 W.	< 100

List of Localities—(*cont.*)

Locality	*Altitude*	*Latitude*	*Longitude*	*Rainfall*
Aburi, Gold Coast	1,400	5.51 N.	0.10 W.	40
Abu Usher, Sudan	(1,200)	(14.54 N.)	(33.14 E.)	(10)
Accra, Gold Coast	< 500	5.33 N.	0.13 W.	25
Aden, Aden Prot.	< 500	12.45 N.	45.04 E.	(5)
Adun, Nigeria	< 500	5.59 N.	8.09 E.	(80)
Afaka, Nigeria	(2,000)	(10.41 N.)	(7.23 E.)	(50)
Agbor, Nigeria	< 500	6.15 N.	6.14 E.	(80)
Aketi, Belgian Congo	(1,500)	2.42 N.	23.52 E.	(65)
Amagburugburu, Uganda	(3,000)	(0.45 N.)	(30.03 E.)	(55)
Amani, Tanganyika	3,000	5.05 S.	38.40 E.	75
Amanzimtoti, Natal	< 500	30.03 S.	30.53 E.	(40)
Anecho, Togoland	< 500	6.15 N.	1.39 E.	(30)
Ango, Belgian Congo	(2,500)	4.03 N.	25.53 E.	(75)
Apapa, Nigeria	< 500	(6.20 N.)	(3.19 E.)	(70)
Arisateb Valley, Eritrea	(2,000)	(15.13 N.)	(36.45 E.)	(15)
Asuboi, Gold Coast	< 500	(5.46 N.)	(0.22 W.)	(50)
Babango, Br. Cameroons	(5,000)	(6.20 N.)	(10.30 E.)	(70)
Badagry, Nigeria	< 500	6.23 N.	2.58 E.	(60)
Bahr el Ghazal, Sudan	(1,200)	(9.30 N.)	(30.00 E.)	(30)
Balovale, N. Rhodesia	3,400	(13.34 S.)	(23.07 E.)	40
Balumi, Belgian Congo	(2,000)	4.10 S.	15.50 E.	(55)
Lake Bangweulu, N. Rhodesia	3,800	11.20 S.	30.00 E.	(50)
Banningville, Belgian Congo	1,100	3.19 S.	17.21 E.	50
Baro, Nigeria	< 500	8.35 N.	6.18 E.	(55)
Basoko, Belgian Congo	(1,500)	1.11 N.	23.40 E.	(75)
Bathurst, Gambia	< 500	13.28 N.	16.40 W.	45
Batiasan, Gold Coast	(1,000)	(10.43 N.)	(1.44 W.)	(40)
Batkanu, Sierra Leone	(500)	(9.05 N.)	(12.27 W.)	110
Bayenga, Belgian Congo	(1,500)	2.19 N.	21.46 E.	(70)
Begamuzi Drift, Zululand	(3,000)	(28.10 S.)	(31.20 E.)	(25)
Bende, Nigeria	< 500	5.32 N.	7.36 E.	(90)
Benikoro, Sierra Leone	(1,500)	(9.43 N.)	(11.27 W.)	(80)
Bihé, Angola	(5,500)	12.18 S.	17.00 E.	(70)
Bindura, S. Rhodesia	3,700	(17.21 S.)	(31.21 E.)	(35)
Bismarckburg, Dahomey	2,300	8.12 N.	0.51 E.	55
Mt. Bizen, Eritrea	(5–8,000)	(15.18 N.)	(39.05 E.)	(15)
Black River, Belgian Congo	(1,500)	3.53 S.	15.55 E.	(55)
Bo, Sierra Leone	< 500	7.55 N.	11.44 W.	120
Boala Karafaia, Sierra Leone	(1,500)	(9.39 N.)	(11.04 W.)	(80)
Bobo-Dioulasso, Ivory Coast	1,400	11.12 N.	4.17 W.	40
Bole, Gold Coast	1,000	9.02 N.	2.29 W.	(40)
Boma, Belgian Congo	< 500	5.50 S.	13.09 E.	(35)
Bondo, Belgian Congo	(1,500)	3.55 N.	23.55 E.	(65)
Bonny, Nigeria	< 500	4.25 N.	7.13 E.	> 100
Bonthe, Sierra Leone	< 500	(7.33 N.)	(12.37 W.)	150
Bor, Sudan	1,700	6.12 N.	31.33 E.	35
Brass, Nigeria	< 500	4.19 N.	6.15 E.	> 100
Brazzaville, Fr. Eq. Africa	(1,000)	4.15 S.	15.20 E.	60
Brits, Transvaal	3,600	25.38 S.	27.47 E.	25
Broomassie, Gold Coast	(500)	8.21 N.	0.58 W.	(45)
Bubukwanga, Uganda	(3,000)	(0.45 N.)	(30.03 E.)	(55)
Budongo Forest, Uganda	(3,500)	(1.45 N.)	(31.34 E.)	(60)
Bugala I., Uganda	(3,800)	(0.24 S.)	(32.16 E.)	(80)
Bugoma Forest, Uganda	(4,000)	(1.20 N.)	(31.00 E.)	(55)
Bugomolo, Uganda	(3,500)	1.31 N.	31.27 E	(55)
Bujuko Forest, Uganda	(4,000)	0.25 N.	32.15 E	(45)

List of Localities—(*cont.*)

Locality	*Altitude*	*Latitude*	*Longitude*	*Rainfall*
Bukakata, Uganda	(4,000)	0.15 S.	32.02 E.	55
Bukasa I., Uganda	(3,800)	(0.26 S.)	(32.30 E.)	(75)
Bukoba, Tanganyika	3,800	1.20 S.	31.48 E.	80
Bulawayo, S. Rhodesia	4,400	20.09 S.	28.37 E.	25
Bundibugiyo, Uganda	3,600	0.42 N.	30.04 E.	55
Bundinyama, Uganda	(3,000)	(0.47 N.)	(30.05 E.)	(55)
Buran, Br. Somaliland	3,000	10.13 N.	48.47 E.	10
Busia, Uganda	(4,000)	(0.28 N.)	(34.05 E.)	(60)
Busi I., Uganda	(3,800)	(0.03 N.)	(32.20 E.)	(60)
Busi R., Mozambique	< 500	(19.55 S.)	(34.20 E.)	(40)
Buta, Belgian Congo	(1,200)	2.48 N.	24.46 E.	60
Butere, Kenya	(4,500)	0.13 N.	34.30 E.	(70)
Buvuma I., Uganda	(3,800)	0.11 N.	33.18 E.	65
Bwigi I., Uganda	(3,800)	(0.28 S.)	(32.24 E.)	(75)
Calabar, Nigeria	< 500	4.57 N.	8.20 E.	125
Cape Coast, Gold Coast	< 500	5.06 N.	1.16 W.	25
Chagwe, Uganda	(4,000)	(0.25 N.)	(33.00 E.)	(55)
Chepalungu, Kenya	5,500	(1.00 S.)	(35.15 E.)	(35)
Chibi, S. Rhodesia	(4,000)	20.19 S.	30.25 E.	(30)
Chindio, Mozambique	< 500	17.39 S.	35.14 E.	(35)
Christiansborg, Gold Coast. *See* Accra.				
Coquilhatville, Belgian Congo	1,200	0.04 N.	18.20 E.	(70)
Costermansville, Belgian Congo	5,300	2.30 S.	28.51 E.	(55)
Dagu, Sudan	(2,000)	(13.39 N.)	(30.08 E.)	(15)
Dakar, Senegal	< 500	14.40 N.	17.26 W.	20
Damazin Cataract, Sudan	(1,000)	(11.44 N.)	(34.25 E.)	(30)
Danagla, Sudan	(1,300)	(14.25 N.)	(33.31 E.)	(15)
Dar-es-Salaam, Tanganyika	< 500	6.50 S.	39.17 E.	45
Darfur Prov., Sudan	(2,500)	(13.00 N.)	(25.00 E.)	(15)
Dar Shol, Sudan	(2,500)	11.54 N.	30.28 E.	(30)
Daru, Sierra Leone	500	(7.59 N.)	(10.50 W.)	90
Mt. Darwin, S. Rhodesia	4,900	16.45 S.	31.38 E.	(35)
Delami, Sudan	(2,300)	(11.52 N.)	(30.20 E.)	(30)
Dendezi, Ruanda-Urundi	(6,000)	(2.28 S.)	(29.03 E.)	(55)
Digio, Kenya	< 500	1.22 S.	40.56 E.	(35)
Diredawa, Abyssinia	(4,000)	9.40 N.	41.59 E.	(30)
Dodowa, Gold Coast	(500)	5.53 N.	0.05 W.	(40)
Dogankade, Gold Coast	(500)	(8.42 N.)	(0.29 W.)	(45)
Doka, Sudan	(1,500)	13.30 N.	34.45 E.	(25)
Dolo, Kenya	(1,000)	(4.08 N.)	(41.48 E.)	(10)
Du River, Liberia	(0–1,500)	(6.15 N.)	(10.25 W.)	> 100
Duala, Fr. Cameroons	< 500	4.03 N.	9.41 E.	160
Dubreka, Ivory Coast	< 500	9.48 N.	13.32 W.	(170)
Dueim, Sudan	1,500	13.59 N.	32.20 E.	10
Duke Town, Nigeria	< 500	(4.55 N.)	(8.19 E.)	> 100
Dumi-Mato, Belgian Congo	(2,000)	4.30 S.	15.45 E.	(50)
Dunkiawallia, Sierra Leone. Not identified.				
Durban, Natal	< 500	29.52 S.	31.03 E.	45
Dwaji I., Uganda	(3,800)	(0.00)	(32.56 E.)	(80)
Eala, Belgian Congo	1,000	0.01 N.	18.30 E.	70
Edudu, Belgian Congo	(2,000)	(3.10 S.)	(16.30 E.)	(60)
Eldoret, Kenya	6,900	0.32 N.	35.16 E.	40
El Fasher, Sudan	2,800	13.38 N.	25.21 E.	10
Elisabethville, Belgian Congo	4,000	11.40 S.	27.34 E.	50
El Obeid, Sudan	2,200	13.11 N.	30.14 E.	15
Embotyi, Cape Province	< 500	(31.30 S.)	(29.50 E.)	(45)

LIST OF LOCALITIES—(*cont.*)

Locality	*Altitude*	*Latitude*	*Longitude*	*Rainfall*
Empangeni, Zululand	< 500	28.46 S.	31.55 E.	40
Entebbe, Uganda	3,900	0.05 N.	32.29 E.	60
Enugu, Nigeria	700	6.27 N.	7.29 E.	70
Epworth, S. Rhodesia	(5,000)	(17.56 S.)	(31.36 E.)	(35)
Erkowit, Sudan	4,300	18.46 N.	36.06 E.	(5)
Eshowe, Zululand	1,700	28.53 S.	31.28 E.	60
Firestone Plantation, Liberia	< 500	(6.18 N.)	(10.25 W.)	> 100
Firiwa, Sierra Leone	(1,500)	(9.20 N.)	(11.18 W.)	(80)
Forcados, Nigeria	< 500	5.26 N.	5.26 E.	130
Fort Hall, Kenya	4,100	0.42 S.	37.10 E.	55
Fort Johnston, Nyasaland	1,700	14.25 S.	35.16 E.	25
Fort Maguire, Nyasaland	1,600	13.40 S.	34.57 E.	(30)
Fort Portal, Uganda	5,100	0.40 N.	30.17 E.	55
Fort Ternan, Kenya	7,000	0.12 S.	35.20 E.	50
Fort Victoria, S. Rhodesia	3,700	20.04 S.	30.46 E.	25
Francistown, Bechuanaland	3,300	21.13 S.	27.30 E.	20
Fransfontein, S.W. Africa	(3,500)	(20.13 S.)	(15.01 E.)	(10)
Freetown, Sierra Leone	< 500	8.30 N.	13.10 W.	160
Funtua, Nigeria	(2,500)	(11.32 N.)	(7.15 E.)	(55)
Gadau, Nigeria	(1,000)	(11.50 N.)	(10.12 E.)	30
Gambaga, Gold Coast	1,300	10.33 N.	0.27 W.	(45)
Garissa, Kenya	(500)	0.27 S.	39.38 E.	10
Garsen, Kenya	< 500	2.16 S.	40.06 E.	(30)
Gatooma, S. Rhodesia	3,800	18.20 S.	29.51 E.	30
Gbohun-Gbohun, Nigeria. *See* Lagos.				
Gedaref, Sudan	2,400	14.02 N.	35.24 E.	25
Gede, Kenya	< 500	3.19 S.	40.01 E.	45
Gedeis, Br. Somaliland	(3,500)	(10.03 S.)	(45.30 E.)	(15)
Geneina, Sudan	3,100	13.29 N.	22.27 E.	25
Godia, Uganda	(4,000)	3.25 N.	30.58 E.	(60)
Goromonzi, S. Rhodesia	(4,800)	(17.51 S.)	(31.22 E.)	(35)
Gotani, Kenya	(1,000)	3.47 S.	39.32 E.	(45)
Grahamstown, Cape Province	1,800	33.18 S.	26.32 E.	30
Grootfontein, S.W. Africa	(4,000)	19.31 S.	18.06 E.	20
Guara Guara, Mozambique	< 500	(25.00 S.)	(32.30 E.)	(25)
Gwelo, S. Rhodesia	4,700	19.28 S.	29.48 E.	25
Hadibo, Sokotra I.	< 500	(12.37 N.)	(54.05 E.)	(15)
Lake Hardin, Abyssinia	(3,000)	(8.52 N.)	(39.50 E.)	(40)
Harrar, Abyssinia	5,500	9.22 N.	42.02 E.	35
Heiban, Sudan	3,400	11.05 N.	30.05 E.	35
Ibadan, Nigeria	700	7.23 N.	3.50 E.	50
Ibi, Nigeria	< 500	8.11 N.	9.43 E.	(45)
Ikeja, Nigeria	< 500	(6.29 N.)	(3.14 E.)	(60)
Ikom, Nigeria	< 500	6.00 N.	8.40 E.	(90)
Ikoyi, Nigeria. *See* Lagos				
Ilado, Nigeria. *See* Lagos.				
Ilambi, Belgian Congo	(1,500)	0.34 N.	24.15 E.	80
Inongo, Belgian Congo	1,100	1.55 S.	18.30 E.	65
Irumu, Belgian Congo	(3,000)	1.25 N.	30.00 E.	50
Isangi, Belgian Congo	(1,000)	0.42 N.	24.15 E.	(80)
Isiolo, Kenya	(4,000)	0.22 N.	37.35 E.	20
Isipingo, Natal	< 500	30.00 S.	30.55 E.	(40)
Itowolo, Nigeria	< 500	(6.28 N.)	(3.17 E.)	(60)
Itwara Forest, Uganda	(5,000)	(0.45 N.)	(30.25 E.)	(55)
Iwonran, Nigeria. *See* Lagos.				
Jadotville, Belgian Congo	(4,300)	11.00 S.	26.44 E.	(50)

LIST OF LOCALITIES—(*cont.*)

Locality	*Altitude*	*Latitude*	*Longitude*	*Rainfall*
Jano I., Uganda	(3,800)	(0.15 S.)	(32.36 E)	(75)
Jebelein, Sudan	1,500	12.37 N.	32.50 E.	(15)
Jebel Gurein, Sudan	(1,400)	(13.39 N.)	(34.41 E.)	(25)
Jebel Jihaf, Aden Prot.	7,100	(13.45 N.)	(44.40 E.)	(10)
Jebel Mandera, Sudan	(1,300)	(14.25 N.)	(33.31 E.)	(15)
Jebel Marra, Sudan	(5–12,000)	13.00 N.	24.20 E.	25
Jebel Meidob, Sudan	(2,500)	(15.18 N.)	(26.25 E.)	10
Jebel Moya, Sudan	(1,500)	(13.28 N.)	(33.22 E.)	(15)
Jefisi, Gold Coast	(1,000)	10.45 N.	2.16 W.	(40)
Jinja, Ugana	3,900	(0.26 N.)	(33.11 E.)	45
Juba, Sudan	1,800	4.51 N.	31.37 E.	35
Jubiya Forest, Uganda	(4,000)	(0.15 S.)	(31.59 E.)	(55)
Kaballa, Sierra Leone	(1,500)	9.39 N.	11.41 W.	80
Kabarole, Uganda. *See* Fort Portal.				
Kabinda, Belgian Congo	3,100	6.08 S.	24.30 E.	65
Kabwoch, Kenya	(4,000)	0.45 S.	34.27 E.	(65)
Kadugli, Sudan	2,000	11.00 N.	29.43 E.	30
Kaduna, Nigeria	1,900	10.30 N.	7.28 E.	45
Kailahun, Sierra Leone	(1,000)	(8.16 N.)	(10.36 W.)	120
Kaimosi, Kenya	5,500	0.05 N.	34.50 E.	70
Kajiado, Kenya	(6,000)	1.51 S.	36.47 E.	(20)
Kajo Kaji, Sudan	4,100	3.53 N.	31.40 E.	50
Kaka Town, Liberia	(1,000)	6.34 N.	10.20 W.	100
Kakamega, Kenya	5,100	(0.14 N.)	(34.44 E.)	70
Kakata, Liberia	(1,000)	(6.30 N.)	(10.25 W.)	100
Kakuri, Nigeria	(1,500)	(10.26 N.)	(7.26 E.)	(45)
Kalinzu Forest, Uganda	(4,000)	(0.25 S.)	(30.05 E.)	(55)
Kallansiya, Sokotra I.	< 500	(12.39 N.)	(53.38 E.)	(15)
Kalora, Sudan	(4,000)	(11.55 N.)	(31.18 E.)	(25)
Kalungu, Uganda	(4,000)	(0.20 S.)	(31.46 E.)	(45)
Kamabai, Sierra Leone	(1,500)	(9.20 N.)	(11.58 W.)	(100)
Kamasiki, Sierra Leone. Unidentified.				
Kampala, Uganda	3,900	0.19 N.	32.35 E.	45
Kano, Nigeria	1,500	12.02 N.	8.32 E.	35
Kaparata, Belgian Congo	3,800	(0.25 N.)	(29.33 E.)	(60)
Karabib, S.W. Africa	3,800	(21.55 S.)	(15.40 E.)	5
Karimi, Belgian Congo	(4,500)	(0.07 N.)	(29.47 E.)	(55)
Kasane, Bechuanaland	(3,000)	17.49 S.	25.09 E.	20
Kasongo, Belgian Congo	(2,000)	4.27 S.	26.39 E.	(50)
Kasyoha Forest, Uganda	(4,000)	(0.20 S.)	(30.10 E.)	(55)
Kassala, Sudan	2,000	15.28 N.	36.24 E.	15
Katagum, Nigeria	(1,000)	12.18 N.	10.20 E.	20
Kateri, Nigeria	1,700	(9.37 N.)	(7.25 E.)	(60)
Kathub, Sokotra I.	< 500	(12.36 N.)	(54.00 E.)	(15)
Katompe, Belgian Congo	(2,500)	6.06 S.	26.24 E.	(40)
Katsina, Nigeria	1,800	13.01 N.	7.30 E.	35
Kau, Sudan	(1,000)	(10.40 N.)	(31.30 E.)	(25)
Kauda, Sudan	(2,500)	(11.01 N.)	(30.33 E.)	(35)
Kayembe-Mukulu, Belgian Congo	(2,500)	(9.30 S.)	(25.36 E.)	(50)
Kericho, Kenya	6,400	0.23 S.	35.17 E.	65
Kerio, Kenya	(4,000)	0.38 N.	35.37 E.	(45)
Khartoum, Sudan	1,500	15.35 N.	32.35 E.	5
Kheiwok, Sudan	(2,000)	12.42 N.	29.09 E.	(15)
Khor Kobwa, Sudan	(2,500)	(4.02 N.)	(30.35 E.)	(55)
Kiambu, Kenya	6,300	1.13 S	36.52 E.	40
Kiansonzi, Uganda	(4,000)	(0.14 N.)	(31.45 E.)	(35)

LIST OF LOCALITIES—(*cont.*)

Locality	*Altitude*	*Latitude*	*Longitude*	*Rainfall*
Kibale Forest, Uganda	(4,500)	(0.30 N.)	(30.26 E.)	(50)
Kibigori, Kenya	(4,000)	0.05 S.	35.03 E.	(65)
Kibokolo do Zombo, Angola	3,800	6.22 S.	15.17 E.	50
Kibos, Kenya	3,800	0.04 S.	34.51 E.	45
Kilembe, Uganda	4,500	(0.25 N.)	(29.59 E.)	(60)
Kilifi, Kenya	< 500	3.37 S.	39.52 E.	40
Kimbao, Belgian Congo	(3,500)	(5.30 S.)	(17.30 E.)	65
Kimberley, Cape Province	4,000	28.42 S.	24.59 E.	15
Kimvula, Belgian Congo	(2,500)	(5.44 S.)	(16.04 E.)	(50)
Kindia, Fr. Guinea	1,400	10.03 N.	12.50 W.	80
Kingangati, Belgian Congo	(2,500)	(4.22 S.)	(15.50 E.)	(50)
Kinshasa, Belgian Congo. *See* Leopoldville.				
Kintampo, Gold Coast	1,200	8.04 N.	1.42 W.	(55)
Kipini, Kenya	< 500	2.32 S.	40.32 E.	(45)
Kiryandongo, Uganda	4,000	1.53 N.	32.03 E.	50
Kisantu, Belgian Congo	1,900	5.07 S.	15.07 E.	(50)
Kisenyi, Ruanda-Urundi	4,800	1.30 S.	29.10 E.	50
Kisii, Kenya	5,700	0.41 S.	34.47 E.	65
Kissy, Sierra Leone	< 500	(8.29 N.)	(13.12 W.)	> 100
Kisui, Belgian Congo	(1,500)	(0.22 S.)	(25.38 E.)	(70)
Kisumu, Kenya	3,800	0.06 S.	34.45 E.	45
Kitale, Kenya	6,200	1.02 N.	35.00 E.	45
Kitasa, Uganda. *See* Entebbe.				
Kitgum, Uganda	3,600	3.20 N.	32.53 E.	50
Kitinda, Uganda. *See* Entebbe.				
Kitui, Kenya	3,900	1.21 S.	38.01 E.	30
Kivanda-Kapepulu, Belgian Congo	(4,000)	(10.00 S.)	(24.00 E.)	(50)
Koinadugu, Sierra Leone	(1,500)	(9.30 N.)	(11.25 W.)	(80)
Komatipoort, Transvaal	500	25.26 S.	31.57 E.	25
Kome I., Uganda	(3,800)	0.05 S.	32.45 E.	(80)
Koru, Kenya	5,900	0.11 S.	35.16 E.	60
Kosti, Sudan	1,500	13.10 N.	32.40 E.	15
Kribi, Fr. Cameroons	< 500	2.59 N.	9.56 E.	110
Kudemsa, Nigeria	(2,000)	(10.23 N.)	(7.33 E.)	(45)
Kudring, Sudan	(2,700)	(11.39 N.	(30.32 E.)	(35)
Kulmasa, Gold Coast	(1,000)	(9.42 N.)	(2.25 W.)	(40)
Kumasi, Gold Coast	(800)	6.43 N.	1.37 W.	70
Kumba, Belgian Congo	(1,500)	(1.50 S.)	(25.50 E.)	(70)
Kumba, Br. Cameroons	800	(4.40 N.)	(9.35 E.)	> 100
Kwamouth, Belgian Congo	1,600	3.12 S.	16.15 E.	60
Kyarumba, Uganda	(5,500)	0.09 N.	29.58 E.	(50)
Kyenjojo, Uganda	4,800	0.36 N.	30.39 E.	45
Kyere, Uganda	3,500	1.29 N.	33.37 E.	50
Lado, Sudan	(1,500)	(5.01 N.)	(31.43 E.)	(35)
Lagos, Nigeria	< 500	6.20 N.	3.20 E.	70
Langata Forest, Kenya	(5,500)	1.20 S.	36.45 E.	(35)
Las Anod, Br. Somaliland	(2,500)	(8.31 N.)	(47.26 E.)	(5)
Laufori, Uganda	(2,500)	3.36 N.	31.35 E.	(50)
Lela, Kenya	(4,500)	0.02 S.	34.36 E.	(65)
Lembwa River, Belgian Congo	(4,000)	6.01 S.	17.06 E.	(60)
Leopoldville, Belgian Congo	1,100	4.20 S.	15.18 E.	55
Letaba, Transvaal	1,800	23.52 S.	30.18 E.	(25)
Leysdorp Road, Transvaal	(2,000)	(24.00 S.)	(30.22 E.)	30
Libenge, Belgian Congo	1,300	3.40 N.	18.39 E.	55
Likoma I., Nyasaland	1,600	12.04 S.	34.44 E.	(75)
Lilixia, Gold Coast	(1,000)	10.46 N.	2.06 W.	(40)

List of Localities—(*cont.*)

Locality	*Altitude*	*Latitude*	*Longitude*	*Rainfall*
Lindi, Tanganyika	< 500	10.00 S.	39.42 E.	35
Li Rangu, Sudan	(2,000)	(4.40 N.)	(28.21 E.)	(55)
Livingstone, N. Rhodesia	3,200	17.50 S.	25.49 E.	25
Loka, Sudan	(1,000)	4.14 N.	31.01 E.	(50)
Lokoja, Nigeria	< 500	7.48 N.	6.44 E.	50
Londiani, Kenya	7,500	0.10 S.	35.36 E.	45
Lorha, Gold Coast	< 500	10.39 N.	2.52 W.	(45)
Louis Trichardt, Transvaal	3,200	23.03 S.	29.54 E.	30
Lourenço Marques, Mozambique	< 500	25.58 S.	32.36 E.	25
Luanda, Kenya	(4,500)	0.02 N.	34.34 E.	65
Lukula, Belgian Congo	< 500	5.22 S.	12.59 E.	45
Luluabourg, Belgian Congo	2,100	5.56 S.	22.18 E.	65
Lumbwa, Kenya	6,300	0.12 S.	35.29 E.	50
Mabang, Sierra Leone	< 500	(8.22 N.)	(12.52 W.)	(130)
Mabira Forest, Uganda	(4,000)	(0.28 N.)	(32.58 E.)	(55)
Maiduguri, Nigeria	1,200	11.49 N.	13.09 E.	20
Makeni, Sierra Leone	< 500	(8.55 N.)	(12.05 W.)	120
Makindu, Kenya	3,300	2.17 S.	37.49 E.	25
Malakal, Sudan	1,500	9.32 N.	31.39 E.	30
Malakisi, Kenya	(4,000)	(0.25 N.)	(34.20 E.)	(70)
Malindi, Kenya	< 500	3.17 S.	40.07 E.	40
Maluku, Belgian Congo	(1,000)	4.04 S.	15.33 E.	(55)
Mambone, Mozambique	< 500	20.58 S.	35.00 E.	(35)
Mambrui, Kenya	< 500	3.07 S.	40.09 E.	(40)
Mamirimiri, Uganda	(3,000)	(0.48 N.)	(30.09 E.)	(55)
Manjuguja North, Uganda	(3,000)	(0.45 N.)	(30.03 E.)	(55)
Mara River, Kenya	(6,500)	1.07 S.	35.08 E.	(45)
Maragua, Kenya	(4,000)	0.47 S.	37.07 E.	(35)
Maranka Reserve, S. Rhodesia	(4,000)	(19.15 S.)	(32.15 E.)	(35)
Margate, Natal	< 500	(30.51 S.)	(30.22 E.)	(45)
Masaka, Uganda	4,300	0.20 S.	31.44 E.	45
Maseno, Kenya	6,000	0.01 S.	34.36 E.	50
Masindi Port, Uganda	3,400	1.42 N.	32.05 E.	40
Matadi, Belgian Congo	< 500	5.50 S.	13.31 E.	45
Matopo Hills, S. Rhodesia	(4,000–5,000)	20.40 S.	28.30 E.	(25)
Maun, Bechuanaland	(3,000)	19.59 S.	23.25 E.	(15)
Mayoro, Gold Coast	(500)	(10.56 N.)	(1.04 W.)	(40)
Mayumba Forest, Gaboon	< 500	3.24 S.	10.37 E.	(60)
Mbango, Uganda	(3,000)	(0.45 N.)	(30.03 E.)	(55)
Mbarara, Uganda	4,700	0.37 S.	30.39 E.	35
Meridi, Sudan	2,900	4.52 N.	29.28 E.	55
Meru, Kenya	6,200	0.03 N.	37.39 E.	60
Meta Gafersa, Abyssinia	(5,000)	(4.50 N.)	(38.45 E.)	(30)
Lake Metahara, Abyssinia	(3,000)	8.52 N.	39.51 E.	(40)
Metu, Uganda	(3,000)	3.39 N.	31.47 E.	(50)
Mhlatuze Settlement, Zululand	(1,000)	(28.40 S.)	(31.45 E.)	55
Middle Point, Nigeria. *See* Lagos.				
Midia, Uganda	(4,000)	3.27 N.	31.01 E.	(50)
Misselele, Br. Cameroons	< 500	(4.06 N.)	(9.25 E.)	85
Mityana, Uganda	(4,000)	(0.24 N.)	(32.05 E.)	(45)
Mnazi Moja, Zanzibar. *See* Zanzibar Town.				
Mocuba, Mozambique	(500)	(16.49 S.)	(37.01 E.)	40
Mombasa, Kenya	< 500	4.03 S.	39.40 E.	50
Mongalla Prov., Sudan	(1,500)	(5.00 N.)	(32.00 E.)	(35)
Mongbwalu, Belgian Congo	4,000	(1.54 N.)	(30.04 E.)	(55)
Mongiro, Uganda	(3,000)	(0.49 N.)	(30.10 E.)	(55)

LIST OF LOCALITIES—(*cont.*)

Locality	*Altitude*	*Latitude*	*Longitude*	*Rainfall*
Monrovia, Liberia	< 500	6.18 N.	10.45 W.	> 100
Morogoro, Tanganyika	1,700	6.50 S.	37.47 E.	35
Moshi, Tanganyika	2,700	3.20 S.	37.32 E.	40
Moyale, Abyssinia	3,900	3.30 N.	39.02 E.	25
Moyamba, Sierra Leone	< 500	8.09 N.	12.22 W.	100
Mozambique, Mozambique	< 500	15.00 S.	40.42 E.	40
Mpumu Forest, Uganda	(4,000)	0.12 N.	32.51 E.	(55)
Msambweni, Kenya	< 500	4.27 S.	39.27 E.	60
Msoneddi, S. Rhodesia	(4,800)	(17.08 S.)	(30.53 E.)	(35)
Mtibwa Forest, Tanganyika	(2,000)	(6.00 S.)	(37.45 E.)	(35)
Mubende, Uganda	5,100	0.35 N.	31.22 E.	45
Mug, Sudan	(2,000)	(12.42 N.)	(29.09 E.)	(15)
Mugusi River, Kenya	(4,500)	(0.30 S.)	(34.42 E.)	(50)
Muhangi Forest, Uganda	(4,000)	0.50 N.	30.45 E.	(50)
Muhoroni, Kenya	4,300	0.09 S.	35.12 E.	60
Mukongoro, Uganda	3,300	1.20 N.	33.53 E.	55
Mukono, Uganda	3,900	0.21 N.	32.45 E.	55
Mumias, Kenya	(4,500)	0.21 N.	34.28 E.	70
Mushin, Nigeria. *See* Yaba.				
Mwanza, Tanganyika	3,700	2.32 S.	32.53 E.	40
Nacon, Gold Coast	(1,000)	(10.50 N.)	(1.25 W.)	(40)
Nahud, Sudan	2,100	12.42 N.	28.26 E.	15
Nairobi, Kenya	5,500	1.17 S.	36.50 E.	35
Naivasha, Kenya	6,200	0.43 S.	36.21 E.	30
Namaacha, Mozambique	(800)	25.58 S.	32.08 E.	40
Namanve, Uganda	3,700	0.21 N.	32.41 E.	50
Nampula, Mozambique	(2,000)	15.06 S.	39.17 E.	45
Nandaw, Gold Coast	(1,000)	(10.44 N.)	(2.18 W.)	(40)
Nandawli, Gold Coast	(1,000)	(10.19 N.)	(2.35 W.)	(45)
Nangudi, Gold Coast	(1,000)	(10.51 N.)	(0.40 W.)	(40)
Nanyuki, Kenya	6,400	0.01 N.	37.05 E.	30
Narok, Kenya	(6,500)	1.05 S.	35.51 E.	25
Nata, Bechuanaland	(4,000)	25.15 S.	25.15 E.	(15)
Navarro, Gold Coast	(1,000)	(10.41 N.)	(1.50 W.)	(40)
Ndanga, S. Rhodesia	(4,000)	20.11 S.	31.20 E.	(40)
Ndola, N. Rhodesia	4,100	12.59 S.	28.38 E.	50
Nefasit, Eritrea	(5,000)	(15.17 N.)	(39.03 E.)	(30)
Nelspruit, Transvaal	2,300	25.27 S.	30.58 E.	40
Nhemancone, Mozambique	(500)	(17.00 S.)	(37.00 E.)	(45)
Niangara, Belgian Congo	(2,500)	3.41 N.	27.55 E.	(65)
Njala, Sierra Leone	< 500	(8.05 N.)	(12.10 W.)	(110)
Nobat Dakim, Aden Prot.	1,100	(13.15 N.)	(44.40 E.)	(5)
Nova Lisboa, Angola	5,700	12.45 S.	15.48 E.	60
Nova Choupanga, Mozambique	(500)	(17.09 S.)	(34.40 E.)	(30)
Nsawam, Gold Coast	< 500	5.48 N.	0.20 W.	(45)
Nta, Belgian Congo	(2,500)	4.10 S.	15.45 E.	(55)
Ntabanana, Zululand	(1,000)	(28.35 S.)	(31.40 E.)	(30)
Ntotoro Valley, Uganda	(2,000–4,000)	(0.50 N.)	(30.00 E.)	(55)
Nuba Mts., Sudan	(2,000–4,000)	11.00 N.	30.30 E.	(35)
Nyamugasani Valley, Uganda	(3,000–12,000)	(0.01 S.)	(29.54 E.)	(50)
Obenge-benge, Belgian Congo	(1,500)	1.33 S.	25.05 E.	(75)
Oblogo, Gold Coast	< 500	(5.36 N.)	(0.17 W.)	(40)
Obuasi, Gold Coast	(700)	6.12 N.	1.40 W.	(60)
Odzi, S. Rhodesia	3,100	18.55 S.	32.25 E.	(35)
Ogbomosho, Nigeria	(1,100)	8.06 N.	4.12 E.	40
Okahandja, S.W. Africa	4,400	21.59 S.	16.56 E.	(15)

LIST OF LOCALITIES—(*cont.*)

Locality	*Altitude*	*Latitude*	*Longitude*	*Rainfall*
Okimbahe, S.W. Africa	(2,500)	(21.21 S.)	(15.23 E.)	(10)
Omatjette, S.W. Africa	(3,500)	21.03 S.	15.32 E.	(10)
Onderstepoort, Transvaal	4,200	(24.47 S.)	(31.15 E.)	30
Opobo, Nigeria	< 500	4.34 N.	7.35 E.	100
Oshogbo, Nigeria	1,000	7.47 N.	4.29 E.	45
Otjimbingwe, S.W. Africa	(2,500)	(22.21 S.)	(16.08 E.)	(10)
Outjo, S.W. Africa	4,000	(20.07 S.)	(16.09 E.)	15
Payida, Uganda	5,000	2.25 N.	30.59 E.	55
Pemba I.	< 500	5.00 S.	39.50 E.	80
Pietersburg, Transvaal	4,200	23.54 S.	29.25 E.	20
Pinna, Gold Coast	(1,000)	10.53 N.	1.45 W.	(40)
Pongwema, Belgian Congo	(2,000)	4.15 S.	16.00 E.	(55)
Ponthierville, Belgian Congo	1,600	0.22 S.	25.28 E.	(75)
Popokabaka, Belgian Congo	(1,500)	5.42 S.	16.40 E.	(55)
Port Harcourt, Nigeria	< 500	4.46 N.	7.11 E.	90
Port Herald, Nyasaland	< 500	17.02 S.	35.15 E.	35
Port Loko, Sierre Leone	< 500	8.46 N.	12.44 W.	105
Port St. Johns, Cape Province	< 500	31.38 S.	29.33 E.	50
Pretoria, Transvaal	4,400	25.45 S.	28.12 E.	30
Pujehun, Sierra Leone	< 500	7.35 N.	11.06 W.	> 100
Quelimane, Mozambique	500	(17.51 S.)	(36.54 E.)	55
Raga, Sudan	1,800	8.28 N.	25.41 E.	45
Mt. Ramlu, Eritrea	(1,000–6,000)	(13.15 N.)	(41.45 E.)	(20)
Ras Malalu, Eritrea	< 500	(15.12 N.)	(39.51 E.)	(10)
Ressano Garcia, Mozambique	< 500	25.26 S.	32.00 E.	(25)
Roberts Field, Liberia	< 500	(6.50 N.)	(11.22 W.)	100
Roberts Heights, Transvaal	(5,000)	25.47 S.	28.08 E.	25
Roseires, Sudan	1,800	11.51 N.	34.23 E.	30
Rumbak, Sudan	1,900	6.48 N.	29.42 E.	40
Rumogi, Uganda	(3,000)	3.34 N.	31.21 E.	(50)
Salisbury, S. Rhodesia	4,800	17.50 S.	31.01 E.	35
Saltpond, Gold Coast	< 500	5.12 N.	1.05 W.	(30)
Sambolugu, Gold Coast	(1,000)	(10.48 N.)	(0.53 W.)	(40)
Sango Bay Forests, Uganda	(4,000)	(0.50 S.)	(31.40 E.)	(45)
San Salvador, Angola	1,900	6.20 S.	14.47 E.	50
Santa Isabel, Fernando Po	< 500	3.46 N.	8.46 E.	> 100
Sapele, Nigeria	< 500	5.53 N.	5.46 E.	(100)
Savelugu, Gold Coast	(500)	9.38 N.	0.50 W.	(40)
Segbwema, Sierra Leone	< 500	(7.59 N.)	(10.58 W.)	(100)
Sennar, Sudan	1,700	13.34 N.	33.34 E.	20
Serakolia, Sierra Leone	(1,500)	(9.37 N.)	(11.08 W.)	(80)
Shaki, Nigeria	(1,500)	(8.34 N.)	(3.19 E.)	(40)
Shaloat, Sudan	(2,000)	(12.42 N.)	(29.09 E.)	(15)
Shamva, S. Rhodesia	3,200	17.20 S.	31.37 E.	(35)
Sheikh Gamal, Sudan	(2,000)	(12.42 N.)	(29.09 E.)	(15)
Sheikh Karim, Sudan	(2,000)	(11.01 N.)	(30.33 E.)	(35)
Sheik Othaman, Aden Prot.	< 500	(12.53 N.)	(45.03 E.)	(5)
Shimoni, Kenya	< 500	4.38 S.	39.23 E.	(55)
Sidamo Prov., Abyssinia	5,900	6.10 N.	38.45 E.	(40)
Singa, Sudan	(1,400)	13.10 N.	33.55 E.	25
Sinoia, S. Rhodesia	3,800	17.22 S.	30.11 E.	30
Sipi, Uganda	6,700	1.20 N.	34.22 E.	(70)
Skukuza, Transvaal	(1,000)	24.59 S.	31.36 E.	20
Sondu River, Kenya	(6,000)	0.31 S.	35.04 E.	(60)
Sonkonia, Sierra Leone	(1,500)	(9.45 N.)	(11.26 W.)	(80)
Sopo, Sudan	(2,000)	(8.06 N.)	(26.08 E.)	(45)

List of Localities—(*cont.*)

Locality	*Altitude*	*Latitude*	*Longitude*	*Rainfall*
Soroti, Uganda	3,700	1.43 N.	33.37 E.	50
Stanleyville, Belgian Congo	1,400	0.26 N.	25.14 E.	65
Sunyani, Gold Coast	1,200	7.22 N.	2.21 W.	60
Tagoi, Sudan	(3,500)	(11.53 N.)	(30.55 E.)	(25)
Takoradi, Gold Coast	< 500	4.53 N.	1.46 W.	40
Talodi, Sudan	2,000	10.37 N.	30.21 E.	30
Tamale, Gold Coast	600	9.28 N.	0.51 W.	45
Tanga, Tanganyika	< 500	5.05 S.	39.08 E.	55
Tanina, Gold Coast	(1,000)	9.55 N.	2.28 W.	(45)
Taveta, Kenya	3,500	3.24 S.	37.40 E.	30
Tembura, Sudan	(2,000)	(5.36 N.)	(27.30 E.)	(55)
Tessenei, Eritrea	(2,000)	(15.08 N.)	(36.39 E.)	(15)
Thika, Kenya	4,900	1.03 S.	37.05 E.	35
'Third Camp', Kenya. Unidentified.				
Thysville, Belgian Congo	2,000	5.16 S.	14.54 E.	(50)
Tirikoro, Sierra Leone	(1,500)	(9.05 N.)	(10.50 W.)	(90)
Tishi, Gold Coast	(1,000)	(11.02 N.)	(0.26 W.)	(35)
Titule, Belgian Congo	(1,500)	3.15 N.	25.35 E.	(75)
Tiwi, Kenya	< 500	4.15 S.	39.35 E.	65
Tomango, Transvaal	2,400	(25.27 S.)	(30.58 E.)	(30)
Torit, Sudan	2,500	(4.25 N.)	(32.33 E.)	40
Triangle Estate, S. Rhodesia	(2,500)	(21.00 S.)	(31.30 E.)	(25)
Tshela, Belgian Congo	800	4.58 S.	12.56 E.	50
Tshumbiri, Belgian Congo	(1,500)	(2.51 S.)	(16.15 E.)	(60)
Tsumeb, S.W. Africa	4,200	19.14 S.	17.42 E.	20
Tsunikitoko, Belgian Congo	(2,000)	4.20 S.	16.20 E.	(55)
Tumu, Gold Coast	1,000	10.52 N.	1.59 W.	(40)
Turbo, Kenya	5,900	0.38 N.	35.03 E.	50
Tzaneen, Transvaal	2,500	23.50 S.	30.10 E.	30
Ubassa, Nigeria	(1,500)	(10.35 N.)	(7.20 E.)	(45)
Ugaro, Eritrea	(2,000)	(14.46 N.)	(37.20 E.)	(20)
Ukara I., Tanganyika	3,900	1.51 S.	33.03 E.	60
Ulu, Gold Coast	(1,000)	(10.42 N.)	(2.47 W.)	(45)
Ulub, Aden Prot.	(3,000)	(13.30 N.)	(44.42 E.)	(5)
Umbeluzi, Mozambique	(500)	26.02 S.	32.20 E.	25
Umm Ruaba, Sudan	1,800	12.53 N.	31.13 E.	15
Umm Sunt, Sudan	(1,500)	(14.20 N.)	(33.35 E.)	(15)
Umtali, S. Rhodesia	3,700	18.58 S.	32.40 E.	30
Upington, Cape Province	2,600	28.27 S.	21.15 E.	10
Upper Sheikh, Br. Somaliland	4,700	(9.56 N.)	(45.12 E.)	20
Usakos, S.W. Africa	2,900	22.01 S.	15.35 E.	5
Usumbura, Ruanda-Urundi	2,600	3.26 S.	29.15 E.	35
River Vakila, Belgian Congo	5,100	(8.30 S.)	(27.15 E.)	(50)
Victoria Falls, S. Rhodesia	3,000	17.52 S.	25.51 E.	20
Wa, Gold Coast	1,100	10.05 N.	2.27 W.	(45)
Wad Banda, Sudan	(2,000)	13.06 N.	27.55 E.	(15)
Wad el Magdub, Sudan	(1,300)	(14.23 N.)	(33.24 E.)	(15)
Wad Ganatir, Sudan	(2,000)	(12.35 N.)	(28.37 E.)	(15)
Wadiyain, Arabia	(1,000)	(15.30 N.)	(47.00 E.)	(5)
Wad Medani, Sudan	1,600	14.24 N.	33.31 E.	15
Waliki, Sierra Leone. Unidentified.				
Waterpoort, Transvaal	2,600	(22.53 S.)	(29.37 E.)	(15)
Waterval Boven, Transvaal	4,800	25.38 S.	30.20 E.	30
Wathen, Belgian Congo	(2,000)	(5.08 S.)	(14.42 E.)	(50)
Wau, Sudan	1,700	7.42 N.	28.01 E.	45
Weenen, Natal	2,800	28.51 S.	30.05 E.	25

List of Localities—(*cont.*)

Locality	*Altitude*	*Latitude*	*Longitude*	*Rainfall*
Wesu, Kenya	(5,000)	3.22 S.	38.20 E.	60
Windhoek, S.W. Africa	5,500	22.34 S.	17.05 E.	15
Winduri, Gold Coast	(1,000)	(10.43 N.)	(0.50 W.)	(40)
Witu, Kenya	< 500	2.22 S.	40.27 E.	45
Wuri, Fr. Cameroons. *See* Duala.				
Yaba, Nigeria	< 500	(6.24 N.)	(3.20 E.)	(70)
Yala, Kenya	(4,500)	0.06 N.	34.32 E.	65
Yambio, Sudan	2,900	4.34 N.	28.24 E.	55
Yangambi, Belgian Congo	(1,000)	0.50 N.	24.15 E.	70
Yaoundé, Fr. Cameroons	2,300	3.52 N.	11.31 E.	65
Yape, Gold Coast	(500)	9.08 N.	1.10 W.	(40)
Yatolema, Belgian Congo	(1,500)	0.18 N.	24.32 E.	(80)
Yeji, Gold Coast	< 500	8.13 N.	0.39 W.	(50)
Yiraia, Sierra Leone	(1,500)	(9.27 N.)	(11.20 W.)	(80)
Yokeskei R., Transvaal	(5,000)	(26.05 S.)	(28.00 E.)	(30)
Yola, Nigeria	900	9.13 N.	12.29 E.	40
Lake Young, N. Rhodesia	(4,500)	(11.14 S.)	(31.44 E.)	(40)
Zaka, S. Rhodesia	(3,000)	(20.21 S.)	(31.24 E.)	(40)
Zanzibar Town, Zanzibar	< 500	6.10 S.	39.14 E.	65
Zika, Uganda. *See* Entebbe.				
Zomba, Nyasaland	3,100	15.21 S.	35.25 E.	55
Zouragu, Gold Coast	(1,000)	10.47 N.	0.47 W.	(40)
Zungeru, Nigeria	(600)	9.45 N.	6.05 E.	45

BIONOMICS IN RELATION TO DISTRIBUTION

The following notes are intended only to illustrate certain aspects of bionomics of particular importance to the study of distribution. The subjects discussed include breeding-places, seasonal distribution, and biting-habits (including vertical distribution). It will be seen that our knowledge of all these matters, with the possible exception of breeding-places, is still very rudimentary. It could have been much less so had collectors realized the importance of publishing full data wherever possible. Observations which may by themselves appear insignificant often acquire considerable significance when related to our knowledge as a whole.

Breeding-places

The fact that the majority of *Stegomyia* breed for the most part in tree-holes or plant axils has had an important bearing on the nature of the distribution records available. Much collecting has been carried out in Africa in the course of malaria surveys, but in work of this kind attention is commonly confined to such breeding-places as ground pools and swamp or stream edges. None of the Ethiopian *Anopheles* is known to breed in tree-holes. As against this, however, it is interesting to recall that two of the Ethiopian *Stegomyia*, *Aēdes africanus* and *Aēdes trinidad*, were first obtained from ground pools. Records of this kind are also available for some other species, e.g. *luteocephalus* (Briscoe, 1950) and *apicoargenteus* (Evans, 1925), but, except where they refer to rock-pools, they may be assumed to be due almost certainly to flushing of tree-holes by heavy rain. All the records quoted are from places with very heavy rainfall. The converse process, contamination of receptacles by ground-pool or stream breeding larvae, also occurs quite commonly. One calabash found by the author in a Ju-Ju shrine in Southern Nigeria contained a thriving population of *Anopheles gambiae, Megarhinus brevipalpis,* and *Aëdes aegypti.* Such cases serve to emphasize the point that, save for certain highly specialized forms, mosquito larvae are capable of a higher degree of tolerance than might be expected from the comparatively restricted range of breeding-places in which they are normally found. The restriction results, in fact, not from the preferences of the larva but from those of the ovipositing female, though no doubt the latter are adapted to providing the larva with optimum conditions for development (see Russell & Rao, 1942, and summary in Bates, 1949). It is probable that no Ethiopian *Stegomyia* breeds exclusively in one type of habitat, and cases in which only a single type of breeding-place is known are probably attributable to insufficient collecting. Nevertheless with the exception of certain highly plastic species (e.g. *aegypti, albopictus*) it is generally possible to distinguish a breeding-place of choice from others which are merely occasional or accidental. The whole question of the selection of breeding-places is a complex one and has never been systematically studied, at least in the present group. It would appear that the adoption of an unusual larval habitat may result from diametrically opposite conditions, namely the absence of suitable breeding-places or the existence of such ideal conditions that a teeming population is produced which 'overflows' into every usable niche.

The list of breeding-places which follows makes no pretence to completeness, but an effort has been made to include the preferred breeding-place of each species, where this is known, together with such records of occasional breeding-places as seem necessary to give an idea of the adaptability of the species in question. The ecology of the various classes of breeding-place is discussed briefly under seasonal distribution.

Aëdes apicoargenteus. Preferred. Tree-holes (Hopkins, 1936; Garnham *et al.*, 1946). *Occasional.* Rock-holes, utensils, bamboo stumps (Hopkins, 1936; Harris, 1942). *Aëdes fraseri. Preferred.* Tree-holes (Hopkins, 1936; Garnham *et al.*, 1946). *Occasional.* Rock-holes (Garnham *et al.*, 1946), rot-hole in mangrove (Holstein in litt.). *Aëdes dendrophilus. Preferred.* Tree-holes (Hopkins, 1936; Van Someren, 1946). *Occasional.* Banana axils, banana and bamboo stumps (Hopkins, 1936), rock-holes (Garnham *et al.*, 1946). *Aëdes africanus. Preferred.* Tree-holes (Hopkins, 1936, also mentions it as common in bamboo stumps). *Occasional.* Utensils (Hopkins, 1936), rock-holes (Garnham *et al.*, 1946), bamboo pots (Robinson, 1950). *Aëdes pseudoafricanus. Preferred.* Rot-holes in *Avicennia* mangrove (Chwatt, 1949). *Occasional.* No other breeding-places have been recorded. *Aëdes simpsoni. Preferred.* Plant axils, especially Colocasia, Gonja banana, and pineapple (Haddow, 1948). May be locally abundant in tree-holes (Hopkins, 1936) or in utensils (Lewis, 1943*a*). *Occasional.* Coco-nut shells, tubs (Hopkins, 1936), rock-pools (Lewis, 1943*a*), a concrete basin (Abbott, 1948), bamboo pots (Robinson, 1950), axils of *Dracaena* and *Strelitzia* (Muspratt, 1950 and in litt.). *Aëdes luteocephalus. Preferred.* Tree-holes (Hopkins, 1936; Lewis, 1943*a*). *Occasional.* Cut bamboos, utensils, crab-holes (? accidental) (Hopkins, 1936), rock-holes (Hopkins, 1936; Abbott, 1948), temporary pools (almost certainly accidental) (Briscoe, 1950). *Aëdes unilineatus. Preferred.* Tree-holes (Hopkins, 1936; Lewis, 1943*a*; Barraud, 1934). *Occasional.* Screw-palm axils (Ingram & De Meillon, 1929), rot-hole in paw-paw (Hopkins, 1936), bamboo pots (Robinson, 1950), bamboo stumps (author, unpublished). *Aëdes metallicus. Preferred.* Tree-holes (Hopkins, 1936). *Occasional.* Utensils, coco-nut shells (Hopkins, 1936), rock-pools (Lewis, 1943*a*), banana axils (Teesdale, 1941), a concrete basin (Abbott, 1948), bamboo pots (Robinson, 1950). *Aëdes vittatus. Preferred.* Rock-pools (including holes in coral, Wiseman *et al.*, 1939) (Hopkins, 1936). *Occasional.* Utensils, hoof-prints, boats, wells (Hopkins, 1936), tree-holes (Kerr, 1933; Rageau in litt.), bamboo pots (Harris, 1942). *Aëdes aegypti.* Common in all kinds of utensils, gutters, boats, water-tanks, &c. May be locally abundant in wells (Hopkins, 1936). Dalziel (1920) records it, surprisingly, as abundant in crab-holes and this has been confirmed by Dunn (1927, &c.) and by Riqueau (1929). Apart from this the dictum enunciated by Carter (1924), that the species is never found breeding right through from oviposition to adult in pools all the sides of which, at the waterline, are of mud, appears to hold good. Berner (1947) gives records from residual pools in earth drains and the author has had similar experiences, but it is extremely difficult in these cases to rule out contamination. Some interesting wild populations have been described, notably by Haddow (1945*a*, 1948) and Garnham *et al.* (1946). Haddow found larvae most commonly in tree-holes, less commonly in plant axils. Garnham and his fellow workers found them most commonly in rock-holes and in holes in recently felled trees, less commonly in true tree-holes (for a discussion of this point see below under seasonal distribution). Robinson (1950) found a high proportion of the tree-hole population to consist of this species. He also gives records from rock-pools which seem to constitute a dry season refuge. Adults of *Aëdes aegypti* recently received from Dr. Fain were bred out from holes in old weathered lava on the lava plain north of Lake Kivu near Sake. These holes were said to be about 10 km. from the nearest human settlement.

SEASONAL DISTRIBUTION

A number of scattered records are available, but their sum total is surprisingly small and little can be gained from attempting to correlate them. Most of our knowledge therefore rests on a few studies pursued continuously over a period in particular localities. There can be no question but that this is a most profitable field for study, and good figures, were they available, would throw much light both on bionomics and on distribution. As it is, so little is known regarding differences between individual species that the subject is best discussed in relation to breeding-places. For this purpose the latter are classified in accordance with common practice as tree-holes, bamboos, plant axils, rock-holes, and artificial containers. It must, however, be emphasized that this is not a natural classification and that even in the present state of our knowledge further subdivision is required.

Tree-holes. Two distinct types were recognized by Garnham *et al.* (1946), who found that the large horizontal tree-hole not uncommonly encountered in fallen tree-trunks was unattractive to most *Stegomyia* although apparently preferred to the smaller type of tree-hole by *Aëdes aegypti*. This is in accordance with the author's experience in Southern Nigeria except that such holes were not found to contain even *Aëdes aegypti*. The 'dominant species' appeared to be *Culex macfiei*. These observations appear to indicate that the attraction for the ovipositing female is not purely a chemical one depending on the nature of the walls of the breeding-place but is to some extent conditioned by the degree of exposure of the water surface to insolation. If this is so, then it might be expected that tree-holes with a more or less vertical opening and deeply shaded interior would be more attractive to certain species than those in the forks of trees with more or less horizontal opening. It is clear also that the situation of the breeding-place relative to shade trees will be of importance. Dunn (1928) made a quantitative study of the fauna of a tree-hole with a small opening *vis-à-vis* one with a large opening. His observations appear to indicate a general preference on the part of *Stegomyia* for the latter, but being based on only a single tree-hole of each type they must be regarded as inconclusive. A number of investigators (Dunn, 1927*a*; Harris, 1942; Garnham *et al.*, 1946; Hocking, 1947; Bailey, 1947) have employed 'artificial tree-holes', made by sawing off joints of bamboo, as traps, and Dunn showed these to be more attractive than containers made of metal. It would be interesting to compare the attractiveness of a container with deeply shaded interior, such as a narrow-necked calabash, with that of a bamboo pot, but this does not appear to have been done.

Larvae of *Aëdes unilineatus, metallicus, aegypti, simpsoni,* and *fraseri* have all been obtained by immersing dried material from tree-holes, and the larva of *Aëdes subargenteus* was first obtained in this way. It is presumed that these species survive through the dry season by means of drought-resistant eggs (Taylor, 1934; Hopkins, 1936; Garnham *et al.*, 1946; Gillett *et al.*, 1950), but it appears highly probable from the distribution studies discussed below that there is some variation in this respect between individual species. Robinson (1950) appears to regard survival in the adult state as more probable in Northern Rhodesia, and Taylor (1934) has an interesting negative record for *luteocephalus*. The possibility of obtaining larvae by immersion of tree-hole scrapings during dry-season surveys should be borne in mind by the collector particularly as such scrapings are much more easily transported than living adults or early stages.

Hatching does not usually take place immediately the first rain falls. Nor is it to be expected that all the eggs in a tree-hole will hatch on the first immersion. Ingram & Macfie (1916*b*) found larvae at Accra in March, i.e. right at the beginning of the rainy season, but Taylor, working at Gadau, noted that 'although a few showers fell during May and June no rainwater remained more than a few hours in any of the tree-holes until the beginning of July', and Muspratt (1945) notes that at Livingstone, where the rainy season lasts from October to May, larvae are usually found from the middle of November onwards. Robinson (1950) states that at Livingstone he found larvae in tree-holes from December to May inclusive and that 'one to one and a half inches of rain falling over a period of one to two weeks is sufficient to initiate breeding in tree-holes, although most holes do not get sufficient water before about three inches have fallen'. It is to be presumed that the last eggs laid in a large tree-hole during the previous year would be near the bottom and would therefore be flooded well before the tree-hole was full, but this point does not appear to have been investigated. In view of Robinson's findings in Northern Rhodesia it seems almost certain that a number of species of *Stegomyia* can survive the dry season as adults in wetter parts of the region. There can be no doubt, however, that the adult population is very drastically reduced even under quite favourable conditions. Thus in Bwamba County during a prolonged dry spell lasting from the end of December to the end of March 20 catches made between 2 February and 11 March yielded only 7 adults of *apicoargenteus* as compared with 198 from 20 catches made during the preceding wet season (Haddow *et al.*, 1947). At Itowolo 7 catches made between 21 November and 16 May yielded 24 *africanus* as compared with 501 from 15 catches between 12 June and 25 October. In this case the number of adults taken declined very sharply even during the short dry spell between the large and small rains and 2 catches made between 24 August and 7 September yielded only 7 *africanus* (Mattingly, 1949*a*). Adults do not, of course, appear in greatest numbers until some time after hatching takes place. At Itowolo greatest numbers of *africanus* were taken shortly before the period of maximum rainfall in July and a second peak occurred shortly after the heaviest rainfall during the small rains. In this case the seasonal distribution of *africanus* was closely paralleled by that of the two species of *Diceromyia* which were the only other tree-hole breeders taken, and it was considered that the type of breeding-place must be the governing factor rather than any intrinsic difference between the species. As against this the figures given by Kerr (1933) for *africanus* and *luteocephalus* in the Yaba area, although small, do suggest the possiblity of a specific difference. In this case *luteocephalus* showed a much smaller peak in relation to the small rains and a correspondingly larger concentration during the period May to July. In addition the average catch obtained during July was more than twice that obtained during June (slightly smaller during July than during June for *africanus* at both Yaba and Itowolo). In Bwamba the wet and dry season catches referred to in connexion with *apicoargenteus* yielded 429 and 34 *africanus* respectively.

Bamboos. Among the Ethiopian *Stegomyia* the only specialized bamboo breeders are confined to the East African Highlands and cannot therefore be discussed here. Most of the Guinean species appear to breed readily in bamboo pots and several of them are known from bamboo stumps, so that it is clear that this type of habitat closely resembles the small tree-hole. Bored bamboos clearly present a distinct type of habitat, but no information appears to be available regarding their utilization by Guinean species. In Southern Nigeria the most characteristic bamboo breeders appear to be *Dunnius* spp.

Plant axils. These are the subject of a most informative paper by Haddow (1948) devoted to the breeding-places and seasonal distribution of *Aëdes simpsoni* in Bwamba County. This author found that at Bundibugiyo with a rainfall of about 55 inches, local rainfall had little direct effect on the numbers of larvae obtained since a light shower was sufficient to fill the plant axils to capacity and heavy rain could not fill them further. Three or four showers a month appeared to be sufficient under normal circumstances to maintain the larval population. Increased rainfall favoured breeding indirectly, however, through its effect on the growth of the plants. A monthly survey of the axils of *Xanthosoma sagittifolium* showed that these only dried out completely for a short period at the beginning of February and the larval population was renewed within 10 days after the first light rain. During the dry season larvae appeared to be able to survive in the merest film of water. During the short period of drought they could be obtained by immersing scrapings from the dry axils, presumably from drought-resistant eggs. It seems that in localities with a higher or better distributed rainfall or in a wetter year larvae would occur all the year round and the necessity for a drought-resistant egg would not exist. At Mombasa, with a mean annual rainfall of only 45 inches, Wiseman *et al.* (1939) found that some banana axils held water throughout the dry season. They found adult *simpsoni* to be most numerous during the drier months and suggested that heavy rainfall might wash the larvae out of pineapple crowns and leaf axils.

Rock-holes. Garnham *et al.* (1946) showed that these are of two different kinds, each supporting an entirely different fauna. Well-shaded holes in boulders in the Kaimosi Forest were found to harbour typical tree-hole breeding species such as *fraseri*, *africanus*, and *dendrophilus*, but exposed pools outside the forest contained only *aegypti* and *vittatus*. Residual pools in stream beds must also be distinguished from those which are directly dependent for their water-supply on rain. Robinson (1950) notes that at Livingstone the occurrence of such pools in combination with tree-holes may serve to provide *Aëdes aegypti* and *vittatus* with natural breeding-places for nine months of the year, whereas tree-holes alone were available only for six months. In general it would seem that the latter species is likely to be most abundant during the dry season when the water level in stream beds is low (see also Gil Collado, 1935). A rain-filled rock-hole exposed to sunlight is in general more liable to rapid desiccation than a tree-hole, and species utilizing such breeding-places must be capable of very rapid larval development. Such a capacity is certainly possessed by *vittatus*, pupae of which have been found in rock holes only 3 days after the onset of rain (Lamborn, 1930). *Aëdes aegypti* is also capable of very rapid development, at least when adequate food is available. On a particularly rich diet this species was found to be capable of completing its development from the moment of hatching to the moment of emergence in 85 hours at normal laboratory temperature (author's unpublished experiments at Yaba).

Artificial containers. These do not form a natural group. Their attractiveness for particular species depends in part on their intrinsic nature and in part on their situation. Shade and proximity to dwellings are important extrinsic factors. Most species, other than *aegypti*, very seldom enter dwellings although some, e.g. *africanus*, *simpsoni*, *luteocephalus*, are occasionally recorded. Even *aegypti* has been shown to prefer natural breeding-places when these are available in sufficient numbers, e.g. in the case of villages situated near forests or shambas (Haddow, 1945*a*; Garnham *et al.*, 1946; Dunn, 1927 *a* and *c*). Receptacles made of natural organic matter, e.g. the bamboo pots used as traps or calabashes, to some extent mimic tree-holes and form a class by themselves. The only species regularly found in small containers made of metal, pottery, or other inorganic substances or in containers in or immediately about houses is *Aëdes aegypti*, and it is evident that its ability to utilize such breeding-places accounts in large measure for its very wide distribution. Nevertheless it cannot account entirely for this phenomenon. It may explain transportation, especially by sea, and occurrence in urban centres with piped or other permanent water-supplies, but it cannot explain occurrence in rural areas where the presence of water in small containers is as much a seasonal phenomenon as its presence in tree-holes. There can be no question that this is a highly adaptable species both with respect to temperature and to rainfall requirements, probably the most adaptable of all the Ethiopian *Stegomyia* with the possible exception of *vittatus*.

In a special class are those very large containers used for conservation, e.g. tanks, cisterns, concrete wells, hollow baobab trees, and these may perhaps be essential to the survival of certain species occurring in very arid parts of the region. Thus Patton (1905) records *Aëdes vittatus* only from such places in the neighbourhood of Aden. Even here, however, fig-trees and residual and other rock pools might be expected to provide natural breeding-places at least in some years.

BITING-HABITS

Under this heading are included three distinct aspects of mosquito behaviour, namely host preference, the biting-cycle, which is an expression of the concentrations of any particular species found biting at various times of day and night, and vertical distribution, which is an expression of the concentrations found at various heights above ground. All these, no doubt, are related reciprocally to distribution, but in the present state of our knowledge the nature and extent of this relationship can only be dimly apprehended. They are accordingly discussed very briefly.

Very little is known concerning host selection in this group. It seems reasonable to suppose that forest species may be, in general, more specific in their preferences than those inhabiting the savannah, and certain observations communicated privately by Dr. Chwatt suggest that *africanus* may be more exclusively addicted to primate hosts than *luteocephalus*. A detailed investigation of this point would be of considerable interest. On the whole the vast and confused literature relating to zoophily and anthropophily in mosquitoes suggests that the majority of species are plastic in the sense that host specificity occurs, if at all, at the level of the strain or biotype rather than that of the species (see, in particular, Galliard, 1936, and Wanson & Nicolay, 1937). In this connexion it may be noted that '*Culex molestus*', usually regarded as a highly anthropophilic form, besides showing a preference for birds over man when given the choice will, like *Culex pipiens* and *Culex fatigans*, produce many more eggs on a meal of bird blood than on one of mammal blood (Mattingly *et al.*, in press, and author's unpublished observations on Lagos *fatigans*). Woke (1937) studied the same question using *Aëdes aegypti* and found that of the various hosts employed man and monkey were the least satisfactory. The figures he obtained, expressed as eggs per mg. of ingested blood, were Monkey 28·2, Man 29·2, Canary 42·4, Turtle 46·3, Rabbit 48·9, Guinea-pig 52·4, and Frog 52·6. As against this Toumanoff (1949) obtained more numerous eggs and greater longevity with human blood than with that of two species of lizards (*Gecko* and *Calotes* spp.). There seems to be no reason to suppose that most mosquito species are any less plastic in this respect than in their host preferences. If this is so, then the species population may be expected to adapt itself to whatever selection of hosts is available in a given locality and we ought not to be surprised if a species which readily bites man in one part of its range refuses to do so in another. A number of inconsistencies of this kind are in fact to be found in the literature relating to the Ethiopian *Stegomyia*. Thus De Meillon (1947*a*) states that in South Africa *Aëdes vittatus* does not bite man, but Robinson notes (in litt.) that it bites in Northern Rhodesia. Garnham *et al.* (1946) noted that 'Adults have rarely been found, biting, in catches in the vicinity of breeding places' in the Kaimosi Forest, while, on the other hand, Leeson has an interesting unpublished record from Malakisi, not far from Kaimosi, where *vittatus* bit in abundance in a wooded ravine but were entirely absent from native huts at a similar distance from the breeding-places. Jannone *et al.* (1946) record it as biting in Eritrea, and Lewis (1943) considered that it was probably the most important vector of yellow fever in the Nuba Mountains because 'it existed in great numbers and bit people by day and in the evening near their homes'. Gil Collado (1935) records the Spanish form as biting man avidly. Similarly Haddow (1945*a*) and Garnham *et al.* (1946) note that adults of forest populations of *aegypti* are very rarely taken biting man. *Aëdes simpsoni* has proved equally elusive in Nigeria and the Gold Coast. Full length 24-hour catches at various heights above the ground failed to yield a single adult although larvae were taken abundantly in nearby banana groves (Bugher *et al.*, in press). Short-period catches at ground level in banana groves at Asuboi also failed to yield any adults although larvae were abundant (author's unpublished observation). On the other hand, it is understood from Dr. F. N. Macnamara that this species was quite often taken biting in the British Cameroons, while Haddow (1945*c*) was able to take 596 adults in the course of ten 24-hour catches in Bwamba County. Bostock & Simpson (1905) state that this is one of the commonest species in the Low Veld region of the Transvaal, suggesting by implication that here also it bites readily. *Aëdes unilineatus* appears very rarely to bite man. The only records of its biting or attempting to bite are two from the Sudan (Lewis, 1947). This author failed to observe it biting in the Nuba Mountains although larvae were common. *Aëdes metallicus* is recorded by Lewis (1943) as biting only very near its breeding-places in the Sudan. Bailey (1947) rarely took adults in Kenya; Wiseman *et al.* (1939) found it to bite freely at Mombasa. Robinson found it to the extent of 2 per cent. among just over 2,000 mosquitoes taken biting man at Livingstone. *Aëdes apicoargenteus* was taken by Haddow *et al.* (1947) in Bwamba and Garnham *et al.* (1946) found it to be 'the dominant species in many adult catches' in the Kaimosi Forest. In Nigeria only 7 specimens were taken during a year's catching (Mattingly, 1949*b*). Garnham *et al.* (1946) took adults of *fraseri* in abundance in deep forest, but Haddow *et al.* (1947) record only one specimen from a considerable number of catches in Bwamba. Haddow, Van Someren, *et al.*, however, record it as biting not uncommonly in this part of its range (in press). Garnham *et al.* (1946) took no adults of *dendrophilus* in Kaimosi, but Haddow, Van Someren, *et al.*, record it as 'quite common' in Bwamba. *Aëdes africanus* seems to bite man readily in all parts of its range, and the same is true of *pseudoafricanus* and *luteocephalus*.

Regarding the biting-cycle it will suffice for present purposes to point out that some species are markedly crepuscular with a strongly marked biting-peak shortly after sunset. These include *africanus* (Haddow *et al.*, 1947; Mattingly, 1949*a*; Kerr, 1933), *pseudoafricanus* (Mattingly, 1949*b*; Chwatt, 1949), *luteocephalus* (Kerr, 1933; Lewis, 1943*a*; Bugher *et al.*, in press), and *metallicus* (Lewis, 1947). Others feed quite readily during the daytime, e.g. *simpsoni* (Haddow, 1945*c*), *vittatus* (Lewis, 1943*a*), *apicoargenteus* (Garnham *et al.*, 1946; Haddow *et al.*, 1947), *dendrophilus* and *fraseri* (Haddow, Van Someren, *et al.*, in press), and possibly *unilineatus* (Lewis, 1947), Concerning hosts other than man little is known, but Haddow & Dick (1948) give an interesting account of *africanus* and *apicoargenteus* feeding on anaesthetized monkeys. De Meillon (1947*a*) took *luteocephalus* on a freshly killed baboon but failed to take any in a Magoon trap baited with a monkey either at 50 ft. or at ground level. Bedford (1928) gives records of *simpsoni* and *metallicus* from horses and cattle.

With respect to vertical distribution evidence is available only for a few species. Acrodendrophilic species, i.e. those biting in greatest numbers in the canopy, include *africanus* (Haddow *et al.*, 1947; Mattingly, 1949*a*; Garnham *et al.*, 1946), *luteocephalus* (Bugher *et al.*, in press; Haddow, Van Someren, *et al.*, in press; De Meillon, 1947), *apicoargenteus* (Garnham *et al.*, 1946; Haddow *et al.*, 1947), and *fraseri* (Garnham *et al.*, 1946). It is very dangerous to base any estimate of the size of the population of such species as *africanus* on ground-level catches. It must be emphasized that such catches can give little or no idea of the relative abundance of a canopy species. Thus in a series of catches in Bwamba Haddow *et al.* (1947) took only 22 out of 502 *africanus* at ground level, while the author (1949*a*) took only 39 at ground level out of a total of 525 at Itowolo. It is true that Kerr (1933) obtained considerable numbers of '*africanus*' on the ground, but this was almost certainly due to the presence of *pseudoafricanus* as a contaminant. The presence of small numbers of the latter species, which is less addicted to the canopy than *africanus*, may also have been responsible for the rather higher percentage taken on the ground at Itowolo than in Bwamba (7·4 per cent. as compared with 4·4 per cent.). It is also essential that catches should be made during the peak biting-time. Species biting mainly on the ground include *dendrophilus* (Haddow, Van Someren, *et al.*, in press), *simpsoni* (Haddow, 1945*c*), *aegypti*, and *metallicus* (Bailey, 1947). Still less is known regarding the vertical distribution of breeding-places. Bailey (1947) obtained *simpsoni* in bamboo pots at ground, level only, and Garnham *et al.* (1946) give a similar observation on forest-dwelling *aegypti*. Teesdale (1945), however, obtained the latter in bamboo pots placed on the tops of coco-nut palms. Garnham *et al.* (1946) obtained *fraseri* and *dendrophilus* at all heights up to 60 ft. (the greatest height investigated), but note that *africanus*, while breeding at heights up to 50 ft., was five times commoner at ground level than higher up.

ZOOGEOGRAPHY

The existence of two major elements in the Ethiopian fauna, a West African on the one hand and an East and South African on the other, has long been recognized. Chapin (1932), basing his conclusions mainly on the birds, has mapped out an approximate boundary for the West African sub-region and Edwards (1941) attempted to fit this to the distribution of the mosquitoes. The latter author gives a list of species supposed to be confined to the forested part of this area or to spread only into the adjacent savannah. Among the *Stegomyia* he includes *Aëdes apicoargenteus*, *fraseri*, *luteocephalus*, and *dendrophilus*. Of these, however, only *apicoargenteus* occurs within the area of more or less continuous closed canopy forest where it is accompanied by *Aëdes africanus*, a species which Edwards does not include and which is certainly found well outside the sub-region. *Aëdes luteocephalus* is not a forest species at all. It is a savannah species which does not enter closed forest. It extends far beyond the boundaries of the sub-region. Of the four species listed by

Edwards only *fraseri* and *apicoargenteus* are even approximately confined to the West African sub-region and even these are found in certain isolated forest areas around the Kavirondo Gulf which lie in Chapin's East African Highland District. *Aëdes dendrophilus* resembles *fraseri* in possessing a restricted forest-fringe type of distribution but, like some birds and Lepidoptera, this species also occurs in the forested parts of Natal, an interesting distribution suggesting that it is a more ancient species than the others, probably a relict from some past pluvial period when the southern forests were more nearly continuous with those of central Africa (see Chapin, 1932: 376, and Moreau, 1933). For general notes on mosquito distribution in the region see Haddow (1945*a*), De Meillon (1947*b*), Lewis (1947), and Abbott (1948).

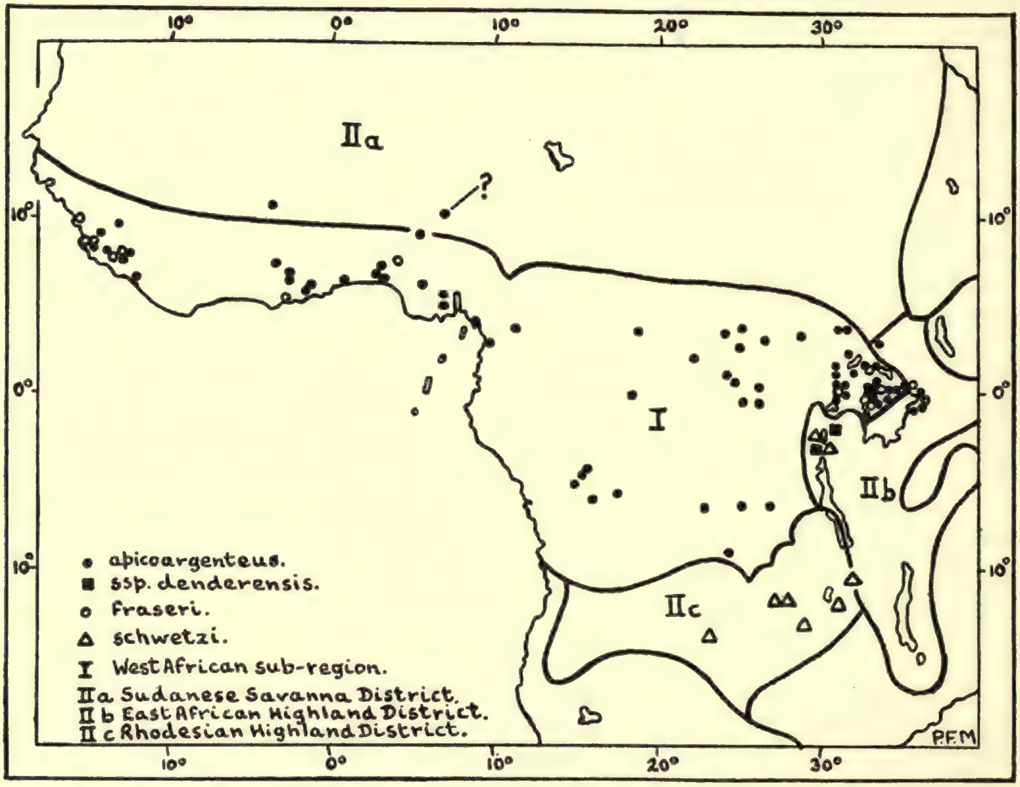

10°
0°
10°
20°
30°
IIa
?
I
IIb
IIc
• apicoargenteus.
■ ssp. denderensis.
o fraseri.
△ schwetzi.
I West African sub-region.
IIa Sudanese Savanna District.
II b East African Highland District.
II c Rhodesian Highland District.
P.F.M.

FIG. 4. Distribution of the *Aëdes apicoargenteus* group.

Of all the West African species only *apicoargenteus* can be said to be typical of the sub-region in the sense that it occupies the whole or a large part of it and extends for only short distances beyond its boundaries (Fig. 4). This species is therefore discussed first.

Aëdes apicoargenteus. In so far as our knowledge goes, the distribution of this species fits Chapin's boundaries very well. The only certain records outside them are from Kitgum and a few localities round the Kavirondo Gulf, all in the East African Highland District, and Lorha in the Sudanese Savanna District. There is also a probable record from Kaduna in this district. All these localities have mean annual rainfalls of at least 45 in., but if the 45-in. isohyet is taken as the limit of distribution, further exceptions must be made, since Accra, Anecho, and Masindi Port certainly, and Katompe and Kiansonzi probably, have a lower rainfall than this. The explanation appears to be that, within limits, the monthly distribution of rain is as important in determining distribution as its total amount. Accra and Anecho lie in the curious dry belt extending approximately from Cotonou to Cape Three Points, where the coast runs parallel to the path of the south-west monsoon instead of cutting sharply across it as it does farther east and west. Although the rainfall in this area is low the proximity of the sea maintains a high atmospheric humidity and the seasonal distribution of rain is very equable, there being, on an average, only 4 dry months (i.e. months with less than 1 in. of rain) at Anecho and 3 at Accra. Even so, however, it is unlikely that *apicoargenteus* occurs permanently within the area since in some years the rainfall is almost certainly too low (e.g. 10·84 in. at Accra in 1926). It is noteworthy that the record from Accra (Macfie & Ingram, 1923*b*) was for December 1918, i.e. the end of a 3-year period of exceptionally heavy rain (41·05 in. in 1916, 44·20 in. in 1917, and 32·37 in. in 1918). Deducing empirical limits from the data available it may be said that *apicoargenteus* is not known to occur anywhere with less than 25 in. and 3 dry months, 30 in. and 4 dry months, or 45 in. and 5 dry months. On this basis we might expect to find the species everywhere in the western part of its range with 5 dry months or less, and such a distribution is in good accordance with the data available. Reliable negative records are few and, in general, no use is made of these in the present paper. Those shown in Fig. 5 (Gadau and Kano) seem to be the only ones of much value in the present instance.

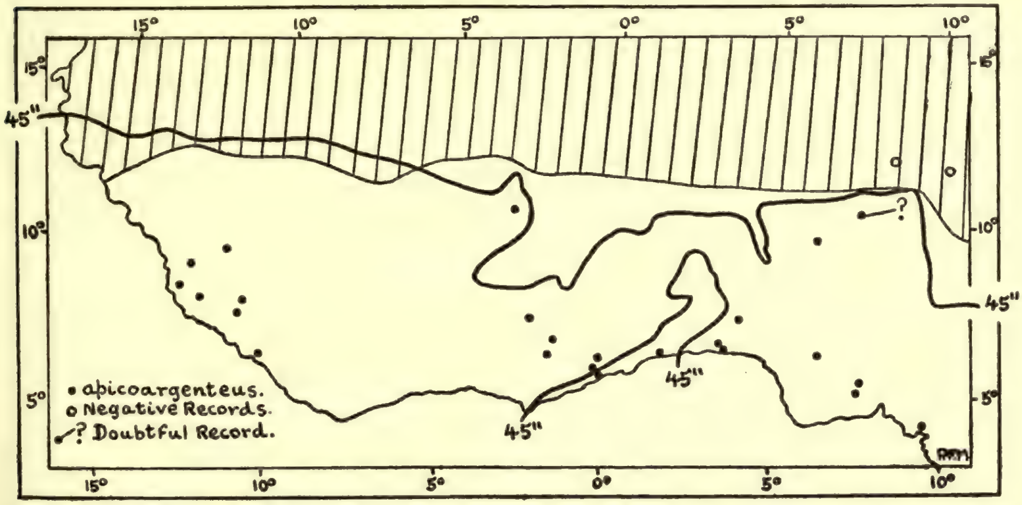


FIG. 5. Distribution of *Aëdes apicoargenteus* in West Africa. The shaded area receives less than 1 in. of rain during each of six or more months in the year. Rainfall contours after Nash (1948).

In the eastern and southern parts of its range the distributional limits of *apicoargenteus* are probably mainly altitudinal. Over almost the whole of Uganda rainfall is high and extremely equable in its annual distribution (Masindi Port and the Kiansonzi area have only one dry month), but there is some reason to suppose that the species may be absent from the extreme northern part of the territory. Thus Lumsden in a recent survey failed to find it beyond Payida in the West Nile Province although other localities visited (Godia, Laufori, Metu, Midia, Rumogi) would seem, to judge from nearby rainfall stations, to have plenty of rain (3 dry months in each case). It cannot, however, be said that reliable negative records have been established for this area, since the survey was a very short one. When the empirical limits deduced for the western part of the range are applied here an exceedingly interesting picture is obtained (Fig. 6). The boundary turns east in the neighbourhood of Juba and again farther north in the neighbourhood of Bor. How far east it runs is unknown since no figures are available from this comparatively little-known part of the Sudan, but it is tempting to suppose that it may join with a similar boundary delimiting the wetter parts of Abyssinia. The similarity of the Abyssinian and West African faunas has often been a matter for comment (see, e.g., Carpenter, 1935), and whether a bridge still exists in this region or not, it seems reasonable to suppose that a relatively slight change of climate would suffice to recreate one. *Aëdes apicoargenteus* is not known from Abyssinia, but so little collecting has been done there that negative records are quite valueless. *Aëdes africanus* is known from the Sidamo Province so that the existence of a fairly recent link between the Abyssinian and Guinean *Stegomyia* may be safely inferred. The more northerly part of the Bor–Pibor region

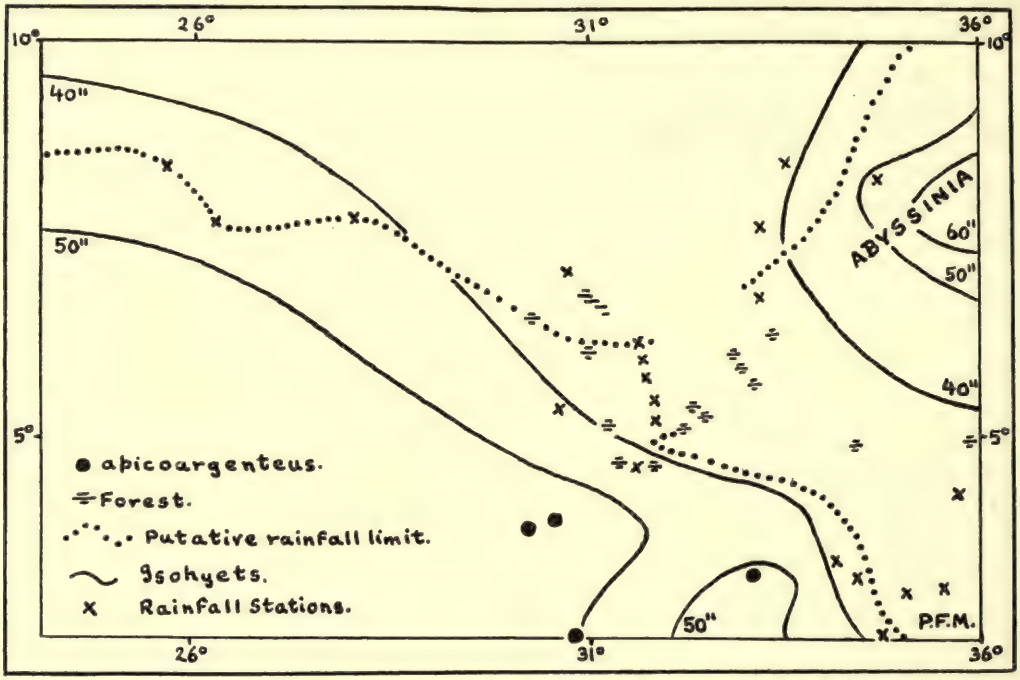


FIG. 6. Distribution of *Aëdes apicoargenteus* in north-east Uganda and the Sudan. Only those rainfall stations are shown which are in the critical area.

is largely swampy and is stated by Lewis (1947) to possess very few trees, but the map (NB 36 of the International Series) shows small isolated patches of forest having the appearance of relicts of a continuous belt running north-east from Mongalla to the Abyssinian border. Collections from these patches of forest as well as from others in the Bor, Mongalla, and Juba areas would be of great interest.

From Mt. Elgon southwards the distribution of *apicoargenteus* is limited well to the west of the 45-in. isohyet by altitudinal factors (Fig. 7). Haddow, Van Someren, *et al.* (in press), report that it does not occur above about 5,500 ft. on the western slopes of Ruwenzori, and Garnham *et al.* (1946) record it up to approximately the same altitude in Kavirondo. This is a critical level for many plants and animals at this latitude (see Chapin, 1932). Considerable areas of northern Tanganyika, while having less than 45 in. of rain in the year, have a sufficiently well-distributed rainfall to support the species, at least on the basis calculated for West Africa. No collecting has, however, been done except at and near Mwanza, from which there is a negative record.[1] Once again surveys of isolated patches of forest would be of considerable interest. In the Kivu Highlands *apicoargenteus* appears to extend up to at most 5,000 ft. Above this it is replaced by *schwetzi* (very rare as far north as this) or more

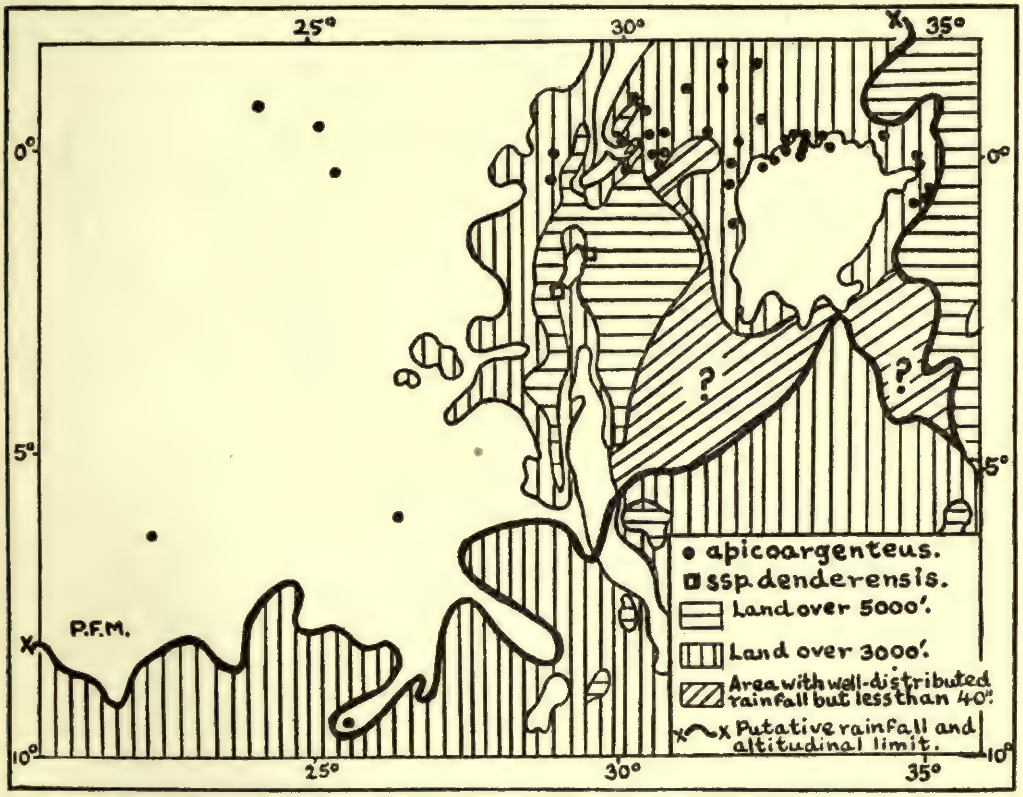

25°
30°
35°
0°
0°
5°
5°
10°
10°
25°
30°
35°
P.F.M.
X
X
X
?
?
● apicoargenteus.
▫ ssp. denderensis.
Land over 5000'.
Land over 3000'.
Area with well-distributed rainfall but less than 40".
X～X Putative rainfall and altitudinal limit.

FIG. 7. Distribution of *Aëdes apicoargenteus* in the southern and eastern parts of its range.

---

[1] See Appendix.

commonly by ssp. *denderensis*. Farther south still, as noted by Chapin for the birds, the altitudinal limit is much lower and it is not known to occur above 2,500 ft. or possibly 3,000 ft. (Kayembe-Mukulu). In the Katanga and the Rhodesian Highlands it certainly does not reach 4,000 ft. (Elisabethville, Ndola), and it is replaced at these altitudes and, farther south still, at 3,500 ft. (Balovale) by *schwetzi*. It seems improbable that this species would be found anywhere in the southern Congo above about 3,000 ft.

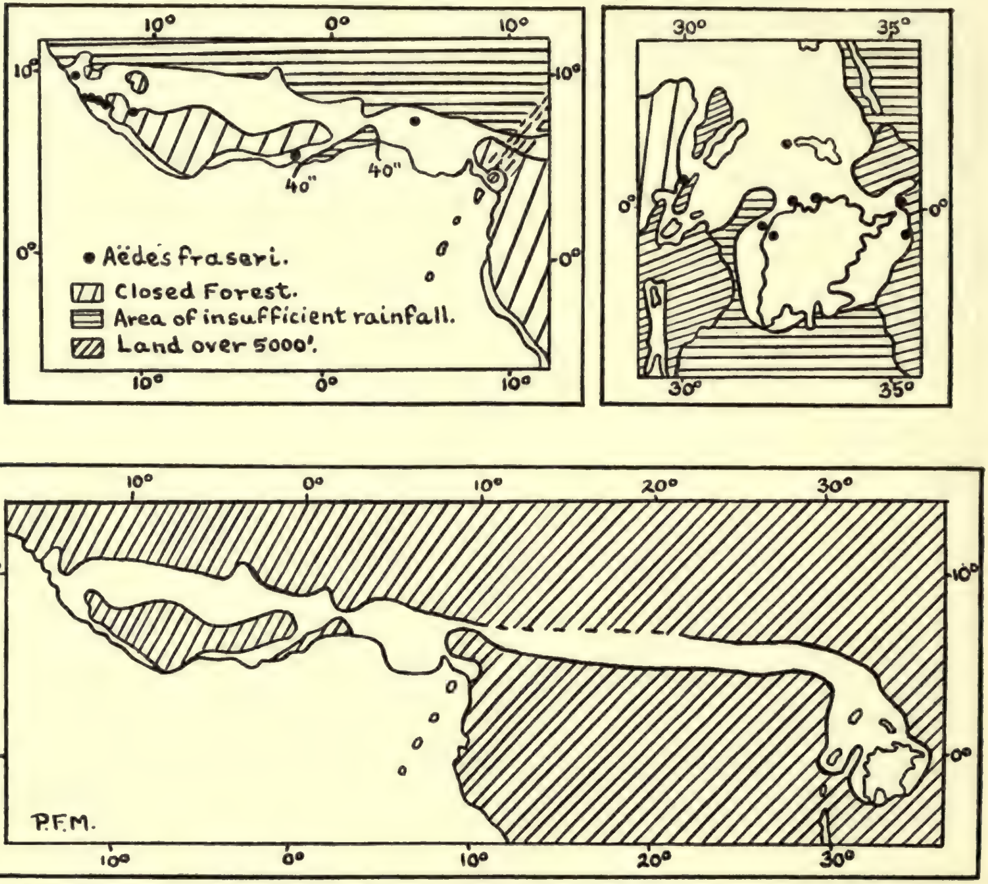


FIG. 8. Distribution of *Aëdes fraseri* in the western and eastern parts of its range and putative range as a whole.

Summarizing the distribution of *apicoargenteus* it may be said that it shows a much less clear-cut relationship to rainfall and altitude than do a number of other species. The explanation may be that it requires for permanent survival in an area a more purely equatorial type of forest than the dry or mixed forests which suffice for, for example, *africanus*. This matter is, however, beyond the scope of the present paper and must be left for discussion in a later one.

Aëdes fraseri. As already noted this species has a peripheral or fringing distribution relative to the main Guinean forests (Fig. 8). Haddow states (in litt.) that, unlike *apicoargenteus* and *africanus*, it is never taken more than a short distance inside the Semliki Crown Forest. Garnham *et al.* (1946) found it in the depths of the Kaimosi Forest, but it would appear that this is a comparatively poor type of relict forest. Chapin (1932: 232) discusses the distribution of birds having a similar habit and states that they follow the northern border of the Congo forests in a narrow band and sometimes extend southwards along the eastern edge of the forests or occur in places along its southern margin. Except at Dubreka *fraseri* is not known to occur anywhere with a rainfall of less than 40 in. or more than 3 dry months. Dubreka has 4 dry months with a rainfall of over 150 in., and here the species is at present known only from mangrove. Applying the limits of 40 in. with 3 dry months or 100 in. with 4 dry months a putative distribution is obtained which is in very good agreement with the known distribution of *fraseri* and the type of distribution described by Chapin (Fig. 8). An extensive area with comparable rainfall also exists in the southern Congo, and it is possible that *fraseri* may be found there although at present there are no records. Similar altitudinal limits appear to apply to this species in Uganda and Kenya to those given for *apicoargenteus* (Garnham *et al.*, 1946; Haddow, Van Someren, *et al.*, in press). It is to be noted that the dry area in the Gold Coast and Togoland and, farther east, the Adamawa Highlands both constitute serious interruptions to the distribution and it would seem that the Upper and Lower Guinean populations may at times be discontinuous.

Aëdes dendrophilus. In the northern part of its range this species appears to have a fringing distribution very similar to that of *fraseri* (Fig. 9), but its putative rainfall limits are even more restricted since it is not known from anywhere with more than 2 dry months in the year.[1] In addition it is also known from an area in Natal with the same type of rainfall and from Fernando Po which suggests that it is a rather ancient species with, at one time, a much wider distribution. This view is also supported by its morphological characters. Its altitudinal limits appear to be much the same as those cited for *fraseri* (Garnham *et al.*, and Haddow, Van Someren, *et al.*, loc. cit.). Various small, isolated areas in the southern part of the continent appear to possess an adequate rainfall for the species and not all of them are at impossible altitudes. Among the more promising are the Haenertsberg–Magoebaskloof area of the Transvaal, the Mbabane region of Swaziland, parts of Mozambique (Vila Paiva d'Andrada and Chinde–Pebane areas), the Inyanga, Morgenster, Bikita, Mt. Silinda, and Umtali regions of Southern Rhodesia, and certain localities in southern Tanganyika at the northern end of Lake Nyasa (Makete, Musekera, Mwitika, Kyela).

Aëdes africanus. Like *apicoargenteus* but unlike *fraseri* and *dendrophilus* this species is found in the depths of closed canopy forest which does not therefore constitute a barrier to its distribution. Among mosquitoes, as noted by Chapin for the birds, this capacity to penetrate thick closed canopy forest is the exception rather than the rule. Unlike *apicoargenteus*, *africanus* has not been found in the dry part of the Gold Coast. It is, however, able to surmount the Rhodesian Plateau and in consequence its distribution is very closely and completely defined by the 40-in. isohyet except to the east of Lake Victoria where there is a complete altitudinal barrier and south of Lake Nyasa where the rainfall is sufficient but its distribution is unsuitable (Fig. 10). The only records from outside the distributional area so defined are those from Zomba (Theobald, 1901) and Mozambique (Howard, 1912), of which the former certainly and the latter very probably fall within an isolated area of adequate rainfall which may well support a relict population (Fig. 11). It is unfortunate that these records can no longer be checked. The putative distributional limits of 40 in. with 4 dry months, 45 in. with 5 dry months, or 50 in. with 6 dry months, deduced empirically from the known distribution, fit this distribution so well that it can scarcely be doubted that they are significant. As to whether their effect on the species is direct or indirect, through the effect on vegetation, is not at present known.[1] The existence of a relict population of this species in Abyssinia has already been referred to. Altitudinal limits appear to be similar to those of *apicoargenteus*, but with a decidedly greater tolerance of high altitude especially in the southern part of the range. Known limits include 5,500 ft. on Ruwenzori (Haddow & Van Someren,

---

[1] See Appendix.

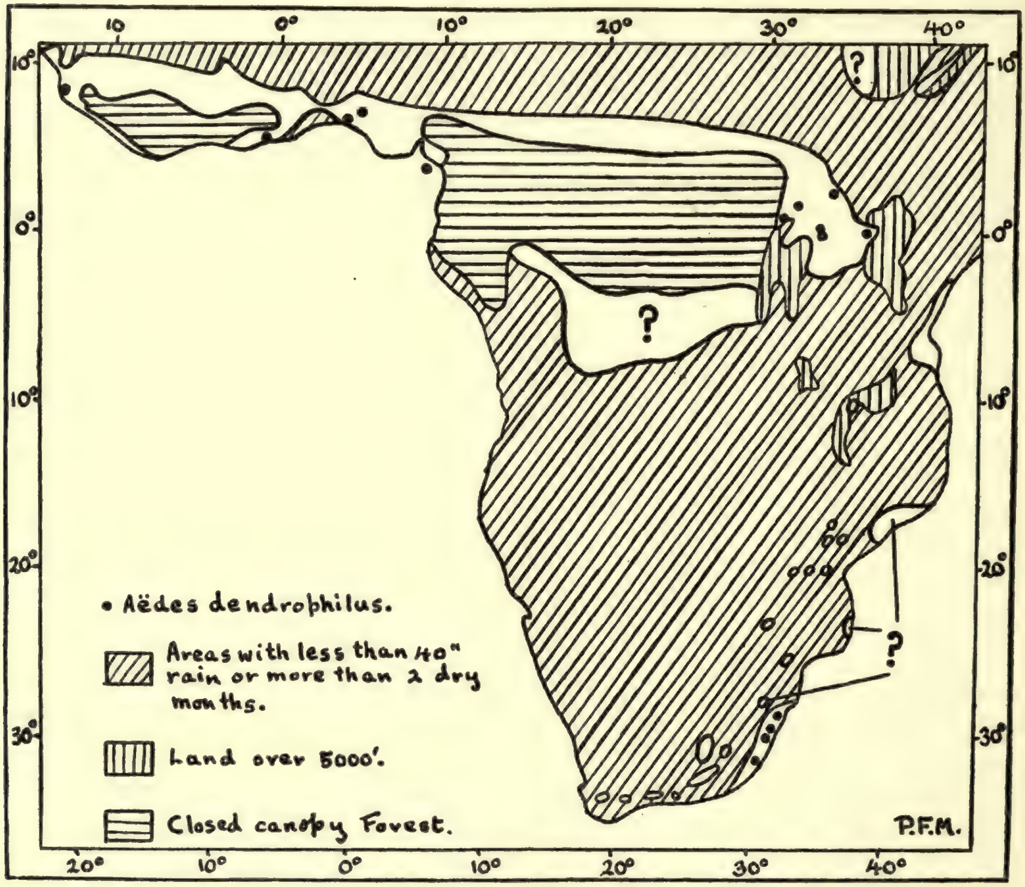

10
0°
10°
20°
30°
40°
10°
0°
10°
20°
30°
10°
0°
10°
20°
30°
?
?
?
• Aëdes dendrophilus.
Areas with less than 40" rain or more than 2 dry months.
Land over 5000'.
Closed canopy Forest.
P.F.M.
20°
10°
0°
10°
20°
30°
40°

FIG. 9. Distribution of *Aëdes dendrophilus.*

---

[1] See Appendix.

1950), about 6,000 ft. in the Kavirondo region (Garnham *et al.*, 1946), about 6,000 ft. in the Kivu Highlands (Costermansville) and in Ruanda (Dendezi), about 5,500 ft. on the Kibara Massif (R. Vakila) and on the Bihé Plateau (Bihé), and about 4,000 ft. on the Rhodesian Plateau (Elisabethville, Ndola). The record from the Sidamo Province of Abyssinia (Bevan, 1937) is associated with an altitude of 5,900 ft.

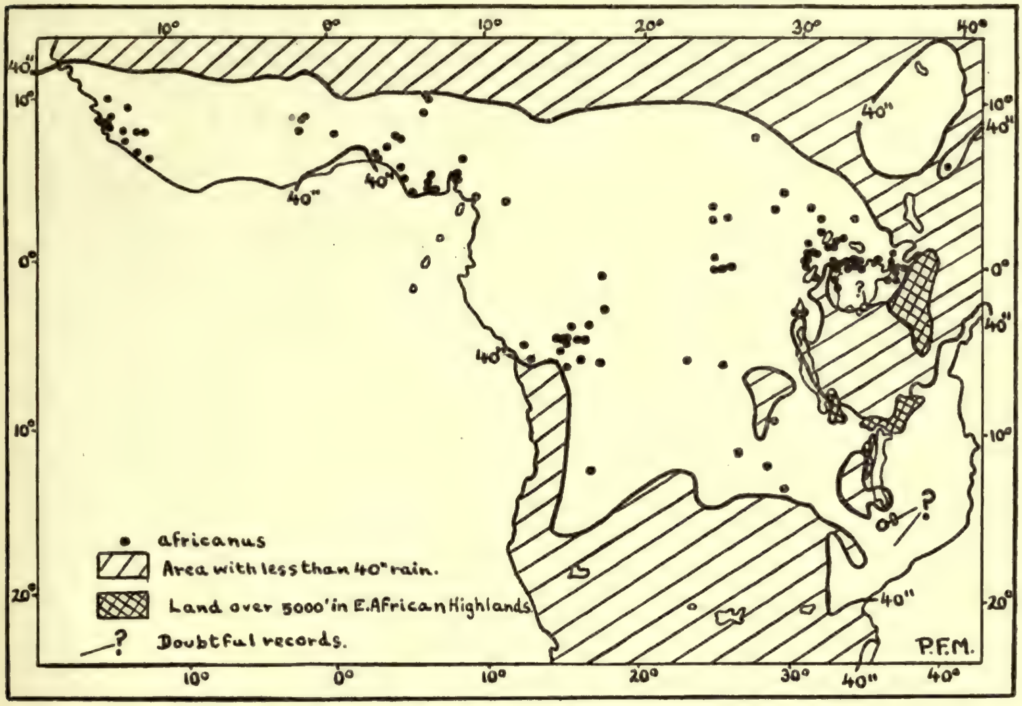

10°
0°
10°
20°
30°
40°
40"
10°
0°
10°
20°
● africanus
▨ Area with less than 40" rain.
▩ Land over 5000' in E. African Highlands
? Doubtful records.
P.F.M.

FIG. 10. Distribution of *Aëdes africanus.*

Aëdes simpsoni. This is the only species, in addition to those already discussed, which occurs in the area of continuous closed canopy forest. Its presence here is almost certainly the result of introduction by man, since Haddow (1945*c*, 1950, &c.) has clearly shown that it is a mosquito of the forest edges and especially of plantations and shambas, and its occurrence in the forest proper is confined to stray individuals and is so rare as to be without significance. Haddow has pointed out, in conversation, that very much traffic takes place in young pineapple and banana plants which frequently contain larvae. As a plant-axil breeder it flourishes in areas of very much lower rainfall than can be tolerated by the species so far discussed. The minimum average rainfall tolerated is, as far as present records go, 20 in. with 8 dry months (Sennar), and the 20-in. isohyet fits the known distribution very well (Fig. 12). These rainfall requirements appear to exclude it entirely from Chapin's Sudanese and Somali Arid Districts and from his South-West Arid District (except in the Bulawayo area). Otherwise it occurs in all the main faunal districts. Its altitudinal limits appear to be much the same as those of *africanus* and it is known from up to about

5,500 ft. on Ruwenzori, 5,000 ft. in the Cameroons and in Eritrea, 6,000 ft. in the Kivu Highlands, 5,500 ft. on the Bihé Plateau, 4,000 ft. on the Rhodesian Plateau, and 4,500–5,000 ft. in the Transvaal (Roberts Heights) and Southern Rhodesia (Salisbury, Bulawayo). It is rare on the Rhodesian Plateau, but Robinson (1950) considers this to be due to the absence of banana plantations. Garnham *et al.* (1946) appear to have found it up to about 6,000 ft. in Kavirondo but, unfortunately, its distribution in other parts of the Kenya Highlands is not known with certainty since no records from altitudes above about 4,500 ft. can now be confirmed. The virtual isolation of the Transvaal and Natal population by a dry belt in Southern Rhodesia and Mozambique has been noted above.

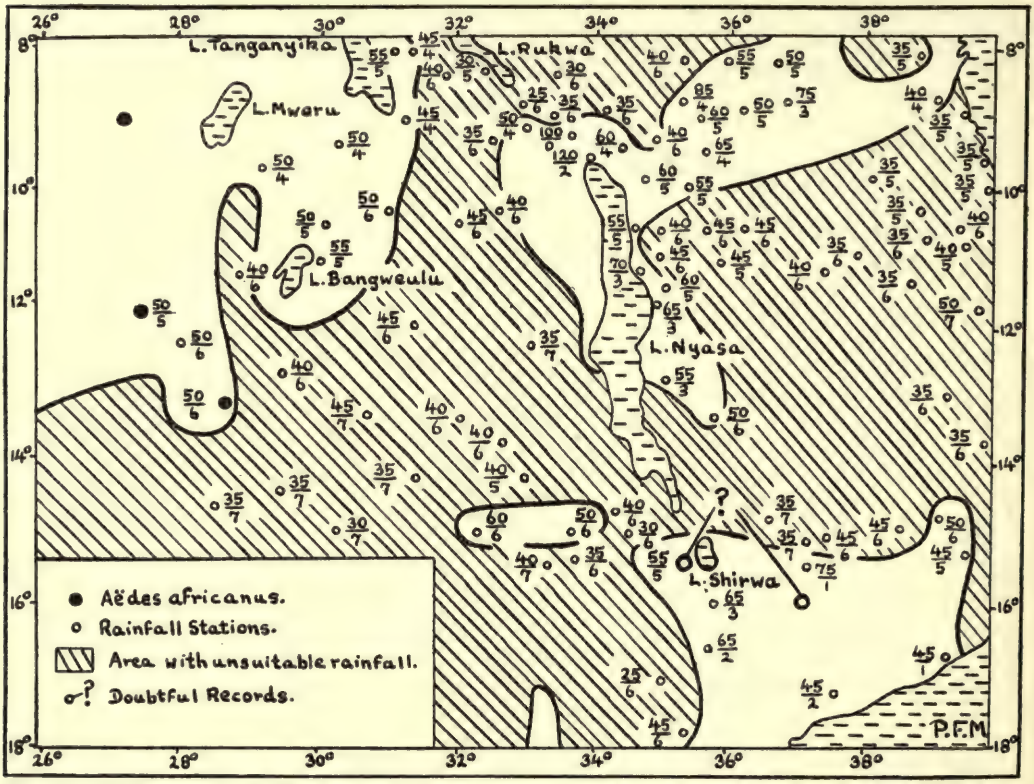

26°
28°
30°
32°
34°
36°
38°
8°
10°
12°
14°
16°
18°
L. Tanganyika
L. Rukwa
L. Mweru
L. Bangweulu
L. Nyasa
L. Shirwa
?
● Aëdes africanus.
○ Rainfall Stations.
▨ Area with unsuitable rainfall.
○? Doubtful Records.
P.F.M.

FIG. 11. Distribution of *Aëdes africanus* in the south-eastern part of its range showing rainfall and number of dry months.

Aëdes luteocephalus (Fig. 13). This species appears, if anything, to be even more reluctant to enter closed forest than *simpsoni*. Haddow has stated, in conversation, that it will not enter the edges of the Semliki Forest even though it may be biting freely in the open. As a corollary to this it appears to be entirely absent from the Upper and Lower Guinean Forests even though it has succeeded in establishing itself in coastal areas where the former has been cleared (e.g. Roberts Field). It has also been recorded from two localities (Adun, Bende) in the western extension of the

Lower Guinean Forest beyond the Cross River. These records cannot now be confirmed from specimens and may have referred to *africanus*. It is in any case probable that the forest in this area has by now been so broken up as to constitute only a partial barrier. It appears to be even more resistant to drought than *simpsoni*, the lowest rainfall recorded anywhere in the northern part of its range being 15 in. with 8 dry months (Danagla and Wad el Magdub in the Wad Medani area). In the southern part of its range it is also known from Maun, which has only 15 in. The record from Nefasit shows that in this part of its range it can occur up to about 5,000 ft., but elsewhere it is rare above about 3,500 ft. In western Kenya it has been recorded from two localities at about 4,000 ft. (Kerio, Fort Hall), but on the Uganda Plateau it is very rare and the only records which can be confirmed are from about 3,000 ft. in the Semliki Valley and from between 3,000 ft. and 4,000 ft. in the West Nile

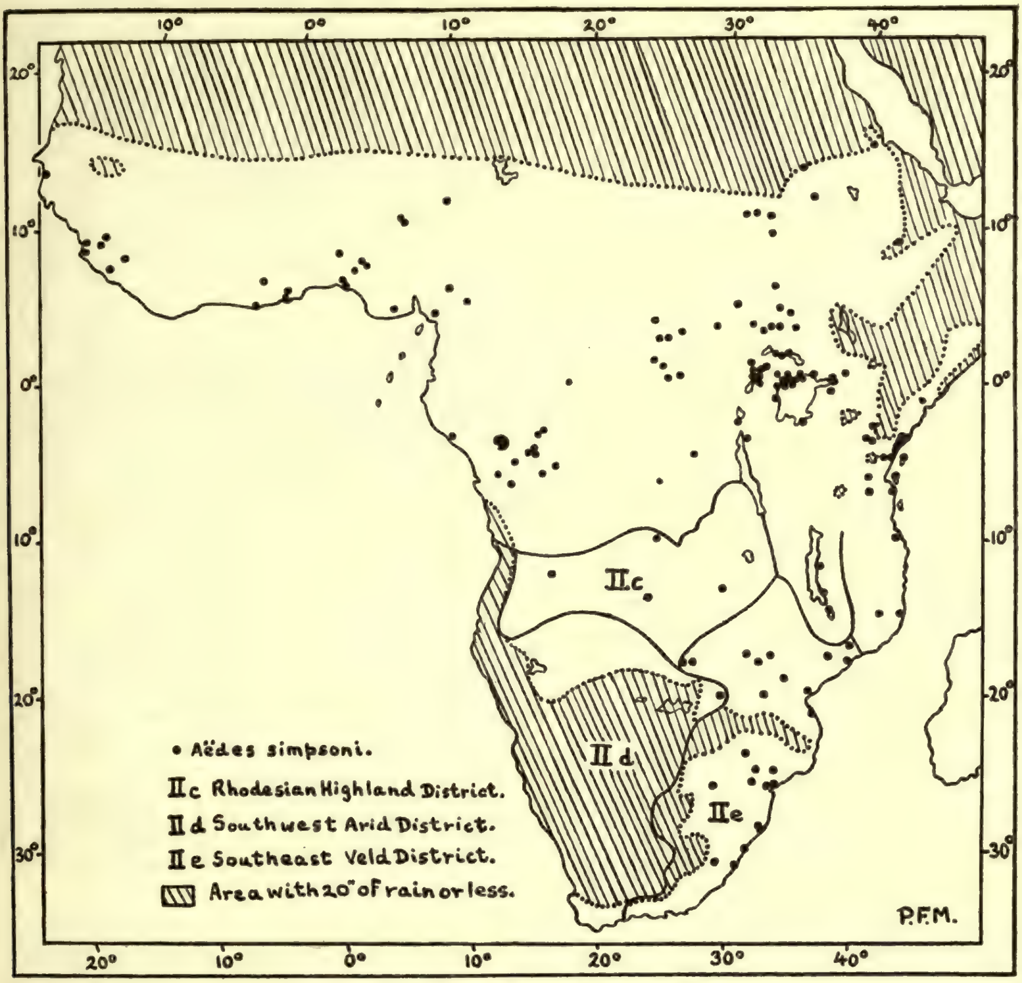

10°
0°
10°
20°
30°
40°
20°
10°
0°
10°
20°
30°
IIc
IId
IIe
• Aëdes simpsoni.
IIc Rhodesian Highland District.
IId Southwest Arid District.
IIe Southeast Veld District.
▨ Area with 20" of rain or less.
P.F.M.
20°
10°
0°
10°
20°
30°
40°

FIG. 12. Distribution of *Aëdes simpsoni*.

Province. The record from Mpumu cannot now be confirmed and may have referred to *africanus*. As against this it seems possible that *luteocephalus* occurring in this region may occasionally have been misidentified as *africanus*. On the Rhodesian Plateau it has been recorded from Balovale (3,400 ft.) and Ndola (4,100 ft.). At Ndola it varies in abundance from year to year and in one year only a single specimen was taken (Robinson in litt.). The eastern limit of its distribution cannot be inferred since no collecting has been done in western Tanganyika. There is a single specimen from Likoma Island off the eastern shore of Lake Nyasa in the London School of Hygiene collection. Nor is it known whether it occurs in Mozambique, but it may be taken as virtually certain that it does not extend nearly as far south as *simpsoni*.

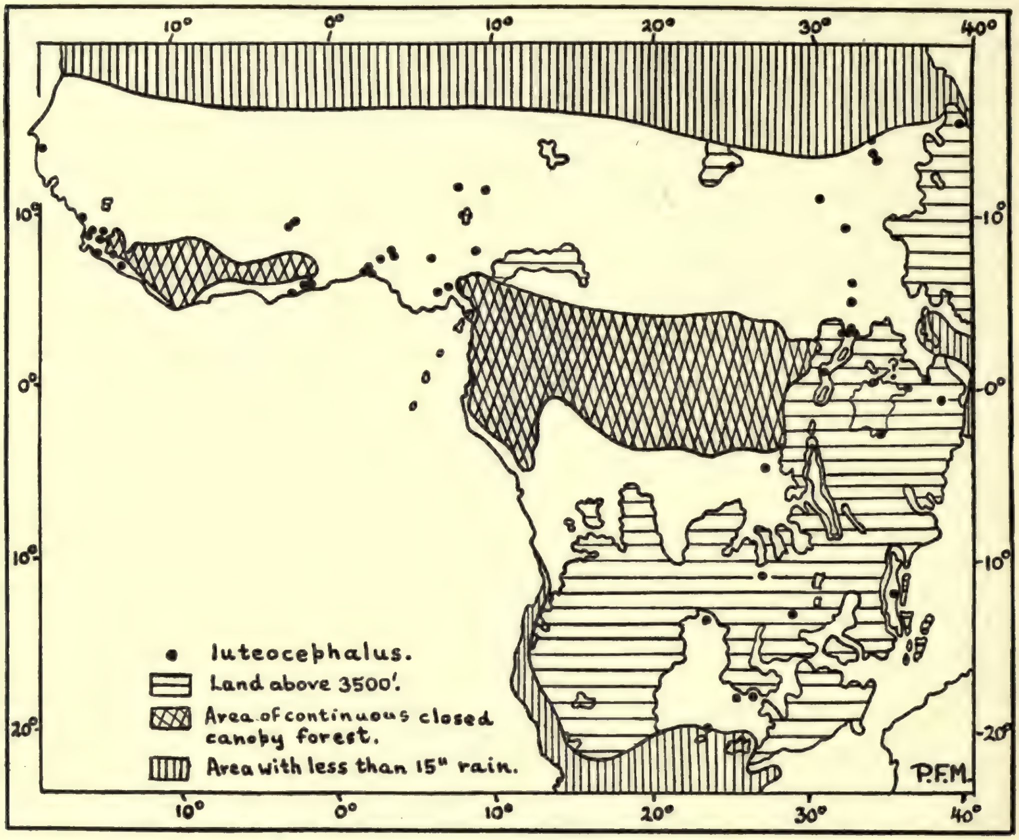


FIG. 13. Distribution of *Aëdes luteocephalus*.

Aëdes unilineatus. This species is of interest as being one of the few Ethiopian *Stegomyia* which also occurs in the Oriental Region. Like *luteocephalus* it is purely a savannah mosquito, but its resistance to drought appears to be even higher and it is on record from several places with rainfalls of about 10 in. (Dolo, El Fasher, Erkowit). Unlike *luteocephalus* it does not occur in deforested areas with high rainfall such as Freetown and it is not, in fact, known from anywhere in Africa with more than 55 in. per annum (Tembura). It is not known whether it occurs in those parts of Arabia with adequate rainfall and there are no acceptable negative records even from the Aden region since it is not clear that anybody has searched in tree-holes. It is stated by persons with local knowledge that the latter are by no means rare in the wetter parts of Arabia, especially in fig-trees growing in the wadis. It is not known from anywhere above 4,000 ft. except Erkowit, which is in the hottest part of its range. Elsewhere the highest altitude recorded is at Fort Victoria (3,700 ft.), and the 3,500-ft. contour probably provides a good approximate boundary. It does not appear to enter forest and this probably serves to exclude it even from those parts of the Congo Basin with less than the empirical limit of 55 in. of rain per annum. The putative distribution is shown inset in Fig. 14. As to whether the southern populations of the Zambesi and Limpopo valleys are linked with the northern population of the Sudanese and Guinean savannahs is not known, but, in view of the fact that it occurs as far east as Dolo, it seems possible that it may extend southward along the edges of the central plateau. The Indian records seem to indicate similar climatic limits with the exception of that from the Bombay area. The rainfall here is about 70 in. per annum. It appears that *unilineatus* is a relict of a fauna which was at one time widespread over much of Asia Minor. Related species still occurring in this

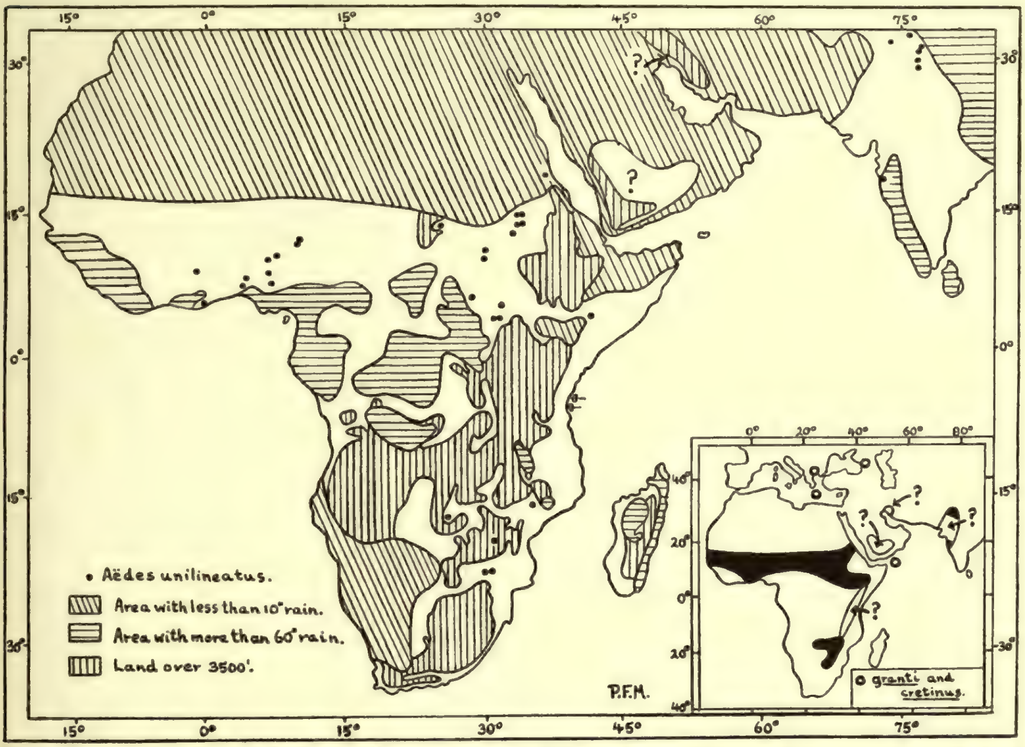


Fig. 14. Distribution of *Aëdes unilineatus.* Inset: Putative distribution of *unilineatus* with that of two related species.

area include *granti*, which is known only from Sokotra, and *cretinus*, which has been recorded from Crete (Edwards, 1921*b*), Macedonia (as *delta*, Séguy, 1924), and Transcaucasia (as *albopictus*, Rhoudkhadzé, 1926; as *lindtropi*, Schingarew, 1927, and see Stackelberg, 1937).

Aëdes metallicus. This species has been recorded from only four localities in the West African sub-region. Two of these (Mbarara and Yambio) are peripheral. The other two (Accra, Asuboi) are in the dry area of the Gold Coast and Togoland (Fig. 15). Its resistance to drought appears to be greater even than that of *unilineatus* and it is the only species so far discussed which occurs widely in Chapin's South-West Arid District. It is not, however, known from Arabia. Despite its almost complete absence from the West African sub-region it is known from several localities in East Africa with quite high rainfall, e.g. Kakamega with 70 in. and Tanga with 60 in. It seems probable that temperature plays a greater part in controlling the distribution of this species than in the case of those previously discussed. Its altitudinal limits

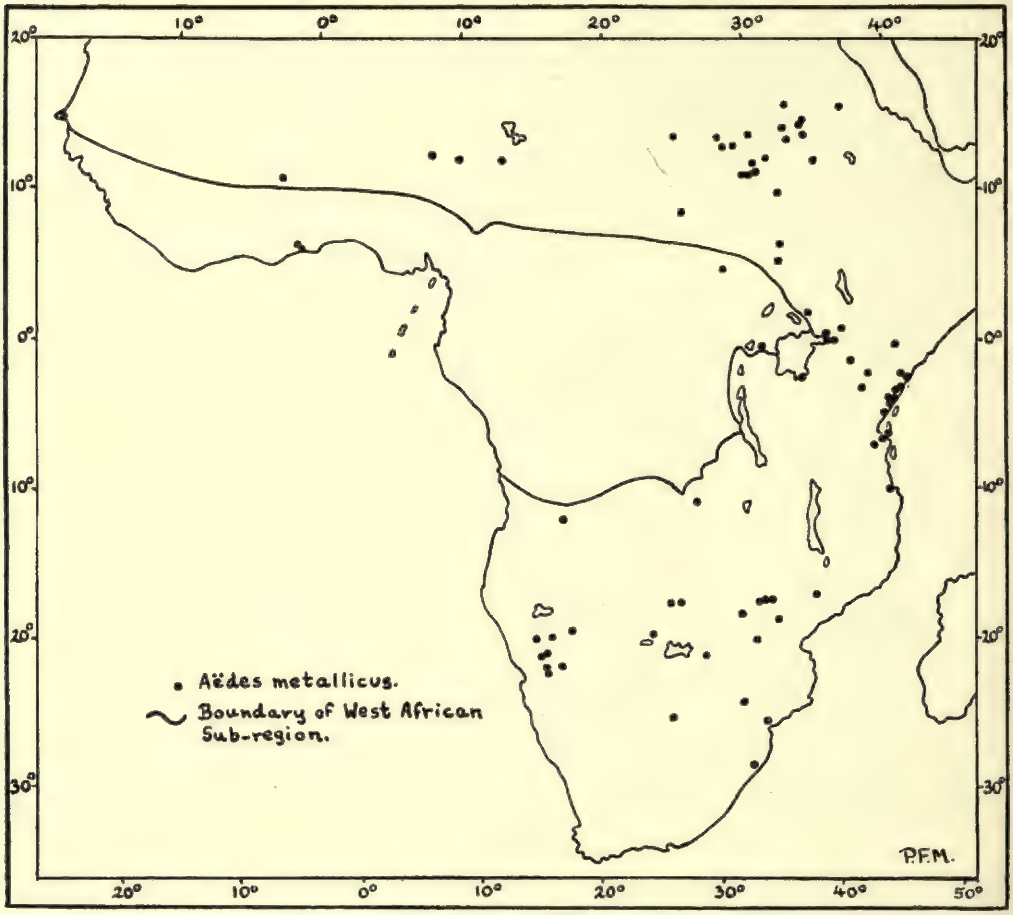


FIG. 15. Distribution of *Aëdes metallicus*.

vary in different parts of the range. In Kenya it has been recorded from an indefinite altitude in the Fort Ternan area (Garnham *et al.*, 1946), apparently about 6,000 ft., and from 5,500 ft. in the Nairobi area. There are no records from the Kivu Highlands and only one from the Rhodesian Plateau (Jadotville, 4,300 ft.). On the Bihé Plateau it apparently occurs at about 5,500 ft. and in South-West Africa it occurs up to about 4,500 ft. (Okahandja). It appears to be absent from the higher parts of the Transvaal where it has not been recorded above about 2,000 ft. (Letaba), but in Southern Rhodesia it occurs up to 4,800 ft. (Salisbury). Morphologically it is unique among the Ethiopian *Stegomyia* in lacking a ventral process from the paraprocts, a feature which recalls the oriental members of the sub-genus. Its mesonotal ornamentation is also unique and suggests a comparison with the *Aëdes longipalpis* group *vis-à-vis* the other Ethiopian *Finlaya*.

Aëdes vittatus. This is the most widely distributed of the species here discussed (with the exception of *aegypti*). It combines drought resistance, due at least in part to its ability to breed in rock-pools, with a marked ability to withstand low temperatures. It is, however, by no means equally common everywhere. In the Lagos area it is extremely rare, having only been recorded once. In Bwamba only a single specimen has been taken (Haddow, Van Someren, *et al.*, in press). It appears to be absent from or extremely rare in a large area of the Belgian Congo, a fact which may perhaps be related to the nature of the surface rocks (Lubilash sandstones, see Chapin, 1932: 30). It is not clear to what extent it enters forest, but Garnham *et al.* (1946) specifically mention its absence from shaded forest rock-holes and there are many indirect references in the literature to suggest that it is largely or entirely a mosquito of the open country. That this does not preclude it, as it apparently precludes *luteocephalus*, from the forested eastern part of the Congo is readily understood from the fact that its breeding-places of preference are commonly found in the exposed beds or edges of streams. The occurrence of this species in Spain is of particular interest since it implies the ability to contend with two sets of adverse conditions, the long, cold winters and the torrential nature of the breeding-places during spring and summer. Gil Collado (1935) notes that it is most abundant in the autumn. It is not known in what stage the winter is passed in this part of the range, although it seems almost certain that it must be in the egg. On the basis of the Ethiopian records alone, this would seem to be more resistant to low temperature than any of the other species discussed, except perhaps *aegypti*, if only because it occurs in a number of places in the Kenya Highlands well above 6,000 ft. (Eldoret, Kericho, Kiambu, Kitale, Mara R., Maseno, Meru, Narok). There is also an interesting record from Sipi (6,700 ft., Hancock & Soundy, 1929), on the Uganda side of Mt. Elgon. As against this there are some rather striking negative records. Patton (1905) notes that it has not been found on the Jebel Jihaf above Ulub. Mara (1945) failed to find it on Mt. Bizen. (This may have been a coincidence, but it seems to be a very common mosquito at lower levels.) It appears to be very rare on the Rhodesian Plateau, where the only records are from Elisabethville and Livingstone, and there is no record from the Kivu Highlands. The likeliest explanation seems to be that the egg is highly resistant to low temperatures as well as to desiccation but the adults and larvae are not. In this case survival would depend on the coincidence between suitable temperature conditions and a low water level in the streams. Records from over 4,000 ft. in the southern part of the range include Bihé, Salisbury, Goromonzi, Gwelo, Msonneddi, Onderstepoort, Yokeskei River, Waterval Boven, and Pietersburg. It is interesting to note that it has not been found as high up as *metallicus* in South-West Africa or as *simpsoni* in Eritrea.

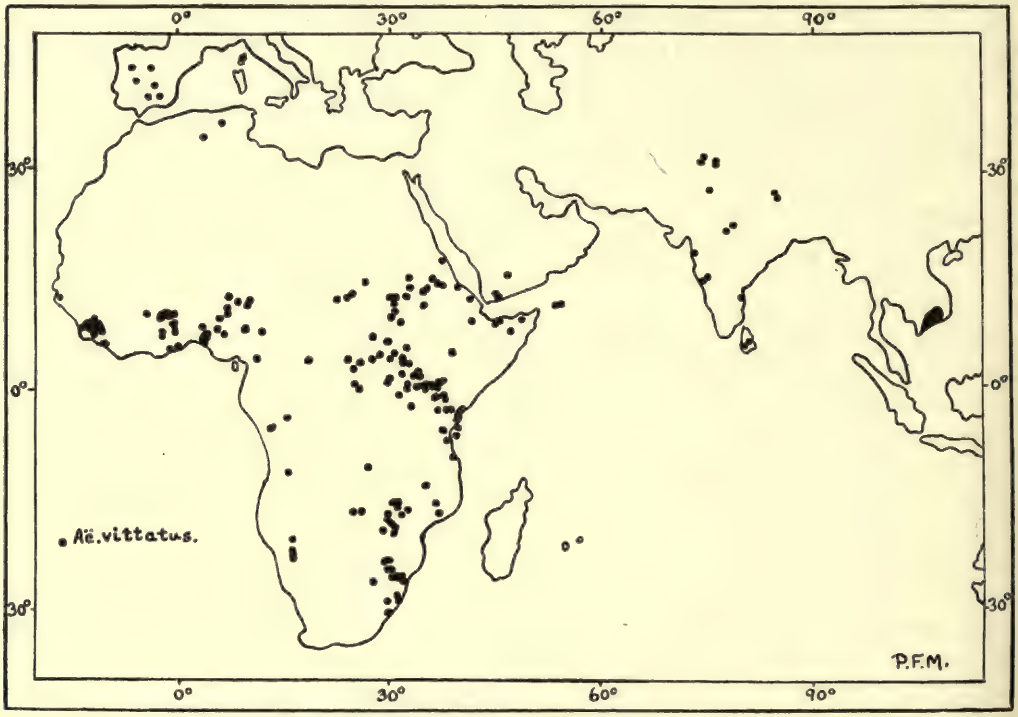


FIG. 16. Distribution of *Aëdes vittatus*.

Aëdes aegypti. For reasons already given it is not proposed to discuss the distribution of this species in detail. Some notes on its altitudinal limits may, however, be of interest as bearing on the general problem of *Stegomyia* distribution and the relationship between the Ethiopian and Palearctic elements in the sub-genus. The most remarkable record of *aegypti* from the Ethiopian region is perhaps that of Mara (1945), who found it at nearly 8,000 ft. on top of Mt. Bizen, and this during by no means the warmest part of the year. That this was a temporary introduction is highly probable, but it seems that larvae at any rate can survive for short periods at temperatures well below those which broadly limit the distribution of the species. Some unpublished records from comparatively high altitudes in Kenya, kindly sent by Mrs. Van Someren, include the following: Eldoret (6,900 ft.), Fort Ternan (7,000 ft.), Kajiado (about 6,000 ft.), Kiambu (6,300 ft.), Londiani (7,500 ft.), Lumbwa (6,300 ft.), Maseno (6,000 ft.), Naivasha (6,200 ft.), Nanyuki (6,400 ft.), Narok (6,500 ft.). Symes (1935) notes that it is particularly abundant at Meru (6,200 ft.). Southerly records from comparatively high altitudes include Salisbury (4,800 ft., Theobald, 1910), Pretoria (4,400 ft., Theobald, 1910), and Windhoek (5,500 ft., De Meillon, 1943). MacGregor (1927) makes the curious observation that in Mauritius *aegypti* seems to be restricted to the coastal belt and is very local while on Rodriguez it is much commoner and is found up to 'at least 800 feet'.

SUMMARY

The present paper deals with the distribution of those species of *Stegomyia* which have been found in the West African sub-region. No species is entirely confined to the sub-region as defined by Chapin. On the basis of this sub-genus it would be reasonable to extend the limits of the sub-region to include all land below 6,000 ft. around the Kavirondo Gulf and, farther north, to a point somewhere east of Kitgum. All published records are listed together with such unpublished records as are at present available. It has been possible to verify, and where necessary amend, the majority of doubtful records by reference to preserved specimens. Records for which this has not been possible are discussed individually. Full distributional records of *Aëdes aegypti* are not given since the data available for this species are so numerous as to require separate treatment. Records of the species discussed in this paper are available from rather more than 500 different localities and these are listed with their altitude, longitude, latitude, and rainfall as nearly as these can be ascertained. Some notes on taxonomy are given, including corrections to published descriptions and some reassignment of specimens and new synonymy. The keys to the sub-genus at present available are extremely misleading and new keys to adults and larvae have therefore been prepared. Full taxonomic treatment is reserved for a later paper. Bionomics are discussed in relation to distribution with particular emphasis on seasonal distribution, the study of which is regarded as crucial for our understanding of every aspect of the group. Zoogeography is discussed principally in relation to rainfall. Temperature will be discussed in a later paper. It is here considered only in so far as its influence is manifested in altitudinal distribution. By far the most serious hindrance to our understanding of the distribution of the group is the absence of records from almost the whole of Tanganyika and Nyasaland. Some points of general interest which have emerged in the course of the work include the existence of a climatic 'bridge' between the Ubangi–Uelle and Abyssinian Highland districts, across the south-eastern extremity of the Sudan, the existence of which may help to explain the strong Guinean element in the Abyssinian fauna. The existence of an isolated population of *Aëdes dendrophilus* in Natal and Pondoland supports the hypothesis of a much wider extension of the African forests in the past already inferred from the distribution of other groups. It is shown that large parts of the Guinean region have the same type of annual rainfall distribution as the part of South Africa in question. Old records, which unfortunately can no longer be checked from specimens, indicate the presence of an isolated population of *Aëdes africanus* in southern Nyasaland and a part of Mozambique. It is shown that the area in question possesses a type of rainfall suited to *africanus* but is separated from that part of Northern Rhodesia in which this species is known to occur by a broad belt in which the annual rainfall distribution is unsuitable. The Upper Guinean Forest, although by no means continuous, appears to be sufficiently so to constitute a

complete barrier to all but five species, and two of these, *aegypti* and *simpsoni*, may have been introduced into its interior by man. *Aëdes vittatus* occurs only in the higher northern and eastern parts of the forest area. Its exclusion from the remainder may be the result of geological factors. It is probable that penetration of those areas in which it does occur has been along stream and river beds since it does not appear normally to enter forest. *Aëdes africanus* and *apicoargenteus* are the only species normally found in the heart of the high, closed canopy, equatorial forest, and both of these extend far into the park savannah; *africanus* also occurs in the Rhodesian dry forest; *fraseri* and *dendrophilus* appear to be restricted to fringing and relict forests of an undefined type. The remainder are savannah species. The relationship of the various species to their characteristic plant associations is almost wholly obscure and will not be understood until much careful work has been done on both the entomological and the botanical side. This subject will be discussed in a later paper.

ACKNOWLEDGEMENTS

I am especially indebted to Dr. A. J. Haddow of the Virus Research Institute, Entebbe, and Mrs. E. C. C. Van Someren of the Medical Research Institute, Nairobi, on whose experience of African mosquitoes I have drawn freely during the preparation of this paper and who have been most generous in the matter of specimens and of information. Others who have very kindly supplied me with specimens or with climatological or topographical data or unpublished distribution records or have otherwise assisted me are Dr. P. H. Abbott of the Civil Hospital, Li Rangu, Sudan; Lt.-Col. M. S. W. Bisdee of Medical Dept. H.Q., British Military Administration, Eritrea; Prof. P. A. Buxton and Mr. H. S. Leeson of the London School of Hygiene and Tropical Medicine; Prof. G. D. H. Carpenter and Prof. G. C. Varley of the Hope Department, Oxford; Dr. G. Ceballos and Dr. S. V. Peris of the Instituto Español de Entomología, Madrid; Dr. L. J. Chwatt of the Yellow Fever Research Institute, Yaba, Lagos; Prof. T. H. Davey, Prof. R. M. Gordon, and Dr. F. O’Rourke of the Liverpool School of Tropical Medicine; Monsieur A. M. L. Deleplanque of the Service de l’Hygiène Publique, Luluabourg, Belgian Congo; Dr. B. De Meillon and Mr. J. Muspratt of the South African Institute for Medical Research, Johannesburg; Dr. A. Duren, Inspecteur Général de l’Hygiène, Ministère des Colonies, Brussels; Mr. A. W. Exell and Dr. Hugh Scott of this Museum; Dr. A. Fain of the Congo Medical Service; Monsieur M. Holstein of the Service Général d’Hygiène, Bobo-Dioulasso; Lt.-Cmdr. K. L. Knight of U.S. Naval Medical Research Unit No. 3, Cairo, Egypt; Dr. W. A. Lamborn of Fort Johnston, Nyasaland; Mr. D. J. Lewis of the Gezira Research Farm, Wad Medani, Sudan; Monsieur M. Lips of the Section d’Études Antimalariennes, Élisabethville; Dr. W. H. R. Lumsden and Mr. J. D. Gillett of the Virus Research Institute, Entebbe; Mr. C. V. Meeser of the Research Laboratory, Salisbury, S. Rhodesia; Mr. H. Merlin of Cirencester, Gloucestershire; Prof. F. Peus of the Zoologischen Museums der Universität, Berlin; Mr. H. St. J. Philby of Jeddah, Saudi-Arabia; Monsieur J. Rageau of the Service de l’Hygiène, Yaoundé, Fr. Cameroons; Mr. G. G. Robinson of the Department of Health, N. Rhodesia; Prof. J. Schwetz of the Université Libre de Bruxelles; Mr. A. Smith of the East African Medical Survey and Filariasis Research, Mwanza, Tanganyika; Dr. A. Stone of the U.S. Dept. of

Agriculture Bureau of Entomology, Washington, D.C.; Mr. G. Swaine of the Agricultural Entomological Laboratory, Morogoro, Tanganyika; and Monsieur J. Wolfs of the Service de l'Hygiène, Costermansville, Belgian Congo. Among many who have indirectly supplied me with information I owe a special debt to the librarians of the Commonwealth Institute of Entomology, the Imperial Institute, the Royal Air Force Meteorological Library, and the Science Museum, London.

REFERENCES*

ABBOTT, P. H. 1948. The Culicidae (Diptera) of Darfur Province, Anglo-Egyptian Sudan, with observations on the geography and zoogeographical relationships of the region. *Proc. R. ent. Soc. Lond.* (B) **17:** 37–48.

ADERS, W. M. 1917*a*. Insects injurious to man and stock in Zanzibar. *Bull. ent. Res.* **7:** 391–401.

—— 1917*b*. *Rep. med. sanit. Serv. Zanzibar*: 35.

ANNETT, H. E., DUTTON, J. E., & ELLIOTT, J. H. 1901. Report of the malaria expedition to Nigeria. *Mem. Lpool. Sch. trop. Med.* Ser. I, **4.**

BACOT, A. W. 1916. Report of the entomological investigation undertaken by the Commission for the year August 1914 to July 1915. *Invest. Rep. Yellow Fev. Comm. W. Afr.* **3:** 1–91.

BAILEY, K. P. 1947. The sylvan mosquitoes of Gede. *E. Afr. med. J.* **24:** 38–41.

BARBER, M. A., RICE, J. B., & BROWN, J. Y. 1932. Malaria studies on the Firestone rubber plantation in Liberia, West Africa. *Amer. J. Hyg.* **15:** 601–633.

BARRAUD, P. J. 1928. The distribution of '*Stegomyia fasciata*' in India, with remarks on Dengue and Yellow Fever. *Indian J. med. Res.* **16:** 377–388.

—— 1934. *The Fauna of British India. Diptera,* **5** (CULICIDAE: Megarhinini and Culicini). London.

BARTHOLOMEW, J. (Ed.). 1922. *Index gazetteer to 'The Times' Survey Atlas of the World.* London.

BATES, M. 1949. *The Natural History of Mosquitoes.* New York.

BEDFORD, G. A. H. 1928. South African mosquitoes. *Rep. vet. Res. S. Afr.* **13** & **14:** 883–990.

BEDFORD, H. W. 1938. *Rep. med. Serv. Sudan* (1937): 77–84.

BEQUAERT, J. 1930. Medical and economic entomology (in Strong *et al.*, *The African Republic of Liberia and the Belgian Congo,* **2:** 797–1001. Harvard).

BERNER, L. 1947. Notes on the breeding habits of *Aëdes* (*Stegomyia*) *aegypti* (Linnaeus). *Ann. ent. Soc. Amer.* **40:** 528–529.

BEVAN, C. E. 1937. Notes on the distribution and breeding-places of mosquitoes in Northern Abyssinia. *Bull. ent. Res.* **28:** 279–287.

BIGOT, J. 1861. Trois Diptères nouveaux de la Corse. *Ann. Soc. ent. Fr.* (4), **1:** 227–229.

BLACKLOCK, D. B. 1925. Notes on a mosquito survey at Daru, Sierra Leone. *Rep. med. Dep. S. Leone* (1924): 61–68.

BOHART, R. M., & INGRAM, R. L. 1948. *Mosquitoes of Okinawa and islands in the Central Pacific.* (U.S. Navy Dep., Navmed 1055.) Washington.

BONNET, D. D. 1950. The hybridization of *Aëdes aegypti* and *Aëdes albopictus* in Hawaii. *Proc. Hawaii ent. Soc.* **14:** 35–39.

BOREL, E. 1930. *Les moustiques de la Cochinchine et du Sud-Annam.* Paris.

BOSTOCK, L., & SIMPSON, C. B. 1905. *Report on the survey of the eastern line of railway of the C.S.A.R.* Germiston.

BRISCOE, M. S. 1947. Insect reconnaissance in Liberia, West Africa. *Psyche, Camb., Mass.,* **54:** 246–255.

—— 1950. Field notes on mosquitoes collected in Liberia, West Africa. *Mosquito News,* **10:** 19–21.

* World List abbreviations, where available, are used throughout.

British E. African Meteorological Dept. 1949. *Summary of rainfall for the year 1948. I. Kenya. II. Tanganyika. III. Uganda.* Nairobi.

Brown, A. G. 1951*a*. *The Yearbook and Guide to East Africa.* London.

—— 1951*b*. *The Yearbook and Guide to South Africa.* London.

Brug, S. L., & Bonne-Wepster, J. 1947. The geographical distribution of the mosquitoes of the Malay Archipelago. *Chronica Naturae,* **103:** 179–197.

Bugher, J. C., Hahn, R. G., Macnamara, F. N., Mattingly, P. F., & Taylor, M. *Studies on yellow fever in an African town.* (In press.)

Butler, G. G., Clearkin, P. A., & Wood, J. Y. 1915. Entomological reports. *Rep. med. Dep. S. Leone* (1914): 51–53.

Callan, H. G., & Montalenti, G. 1947. Chiasma interference in mosquitoes. *J. Genet.* **48:** 119–134.

Carpenter, G. D. H. 1935. The Rhopalocera of Abyssinia: a faunistic study. *Trans. R. ent. Soc. Lond.* **83:** 313–448.

Carter, H. F. 1916. *Rep. Accra Lab.* (1915).

Chapin, J. P. 1932. The birds of the Belgian Congo (1). *Bull. Amer. Mus. nat. Hist.* **65.**

Chwatt, L. J. 1949. *Aëdes* (*Stegomyia*) *pseudoafricanus* sp. n., a new species of *Aëdes* from the coast of Nigeria (British West Africa). *Nature, Lond.* **163:** 808.

Clavero, G. 1946. Aedinos de España. *Rev. Sanid. Hig. publ., Madr.* **20:** 1205–1232.

Connal, A. C. 1915–1930. *Rep. med. Res. Inst. Nigeria* (1914–1929).

Dalziel, J. M. 1920. Crab-holes, trees and other mosquito sources in Lagos. *Bull. ent. Res.* **11:** 247–270.

Davey, T. H. 1933. A survey of the house-haunting mosquitoes of Freetown and Kissy. *Rep. med. Dep. S. Leone* (1932): 74–77.

—— 1939. Report of the Sir Alfred Jones Laboratory, Freetown. Ibid. (1938), Appendix D: 54.

De Meillon, B. 1928. Notes on some mosquitoes found in South Africa. I. *S. Afr. J. Sci.* **25:** 316–324.

—— 1942. *Rep. S. Afr. Inst. med. Res.* (1941): 29.

—— 1943. New records and new species of Nematocera (Diptera) from the Ethiopian Region. *J. ent. Soc. Sthrn. Afr.* **6:** 90–113.

—— 1947*a*. New records and species of biting insects from the Ethiopian Region II. Ibid. **10:** 110–124.

—— 1947*b*. The Anophelini of the Ethiopian geographical region. *Publ. S. Afr. Inst. med. Res.* **10** (No. 49).

—— & Lavoipierre, M. 1944. New records and species of biting insects from the Ethiopian Region. *J. ent. Soc. Sthrn. Afr.* **7:** 38–67.

—— & Rebelo, A. 1941. Culicini (Diptera Nematocera) from the colony of Moçambique. *Moçambique,* **27:** 69–79.

Doreau, P. 1909. Notes de géographie médicale sur l'Abyssinie. *Ann. Hyg. Méd. colon.* **12:** 5–31.

Downs, W. G., & Baker, R. H. 1949. Experiments in crossing *Aëdes* (*Stegomyia*) *aegypti* Linnaeus and *Aëdes* (*Stegomyia*) *albopictus* Skuse. *Science,* **109:** 200–201.

Dunn, L. H. 1926. Mosquitoes bred from dry material taken from holes in trees. *Bull. ent. Res.* **17:** 183–187.

—— 1927*a*. Mosquitoes breeding in 'test' water containers. Ibid. **18:** 17–22.

—— 1927*b*. Tree-holes and mosquito breeding in West Africa. Ibid. **18:** 139–144.

—— 1927*c*. Observations on the oviposition of *Aëdes aegypti* in relation to distance from habitations. Ibid. **18:** 145–148.

—— 1928. Further observations on mosquito breeding in tree-holes and crab-holes. Ibid. **18:** 247–250.

Duren, A. N. 1929. Contribution à l'étude des Culicidés du Congo Belge, Province du Congo-Kasai. *Ann. Soc. belge Méd. trop.* **9:** 97–115.

—— 1938. État actuel de nos connaissances sur les Anophèles du Congo Belge. Ibid. **18:** 557–580.

EDWARDS, F. W. 1912. A synopsis of the species of African Culicidae other than Anopheles. *Bull. ent. Res.* **3:** 1–53.

—— 1914. *Voyage de Ch. Alluaud et R. Jeannel en Afrique Orientale (1911–1912). Résultats scientifiques. Insectes. Diptères.* II. *Nematocera.* Paris.

—— 1917. Notes on Culicidae with descriptions of new species. *Bull. ent. Res.* **7:** 201–229.

—— 1921*a*. Mosquito notes II. *Bull. ent. Res.* **12:** 69–80.

—— 1921*b*. A revision of the mosquitoes of the Palaearctic Region. Ibid. **12:** 236–351.

—— 1923. Mosquitoes reared by Dr. W. E. Haworth from coconut palms in East Africa. *Trans. R. Soc. trop. Med. Hyg.* **16:** 498–501.

—— 1926. Mosquito notes VI. *Bull. ent. Res.* **17:** 101–131.

—— 1932. *Genera Insectorum.* Fasc. 194. (Diptera, Culicidae.) Brussels.

—— 1936. New African culicine mosquitoes (Diptera, Culicidae). *Proc. R. ent. Soc. Lond.* (B) **5:** 49–55.

—— 1941. *Mosquitoes of the Ethiopian Region,* **3** (Culicine adults and pupae). London: Brit. Mus. (Nat. Hist.).

—— & GIBBINS, E. G. 1939. *Ruwenzori Expedition 1934–1935.* **1** (3) (Culicidae). London: Brit. Mus. (Nat. Hist.).

ENDERLEIN, G. 1923. Zur Kenntnis afrikanischer und orientalischer Culiciden. *Wien. ent. Ztg.* **40:** 25–27.

EVANS, A. M. 1925. Notes on Culicidae collected in Sierra Leone, with descriptions of new species and a new variety. *Ann. trop. Med. Parasit.* **19:** 119–126.

—— 1926. Notes on Freetown mosquitoes with descriptions of new and little known species. *Ann. trop. Med. Parasit.* **20:** 97–106.

FAIN, A., & HENRARD, C. 1948. Quelques moustiques du fleuve Congo (Cheval) et des rivières Kasai et Kwango. *Ann. Soc. belge Méd. trop.* **28:** 7–20.

FARNER, D. S., DICKE, R. J., SWEET, G., ISENHOUR, L., & HSIAO, T. Y. 1946. *The distribution of mosquitoes of medical importance in the Pacific area.* U.S. Navy Dep., Navmed 983.

FINDLAY, G. M., KIRK, R., & MACCALLUM, F. O. 1941. Yellow fever and the Anglo-Egyptian Sudan: distribution of immune bodies to yellow fever. *Ann. trop. Med. Parasit.* **35:** 121–139.

GALLIARD, H. 1931. Culicidés du Gabon II. *Ann. Parasit. hum. comp.* **9:** 514–529.

—— 1936. L'anthropophilie de *Culex fatigans* au Tonkin. *Bull. Soc. Path. exot.* **29:** 517–518.

GAMBLE, M. 1912. An English translation of questions asked by General Faria Leal, administrator of San Salvador do Congo, of Dr. Gamble *re* sleeping sickness. *J. trop. Med.* (*Hyg.*), **15:** 62–63.

—— 1914. A list of blood-sucking arthropods from the lower Congo with a vocabulary. Ibid. **17:** 148–150.

GARNHAM, P. C. C., HARPER, J. O., & HIGHTON, R. B. 1946. The mosquitoes of the Kaimosi Forest, Kenya Colony, with special reference to yellow fever. *Bull. ent. Res.* **36:** 473–496.

GILCHRIST, B. M., & HALDANE, J. B. S. 1947. Sex linkage and sex determination in a mosquito, *Culex molestus. Hereditas, Lund,* **33:** 175–190.

GIL COLLADO, J. 1935. Nuevos datos sobre la distribución del *Aëdes* (*Stegomyia*) *vittatus* en España con algunas notas acerca de su biología. *Med. Países cálidos,* **8:** 1–4.

—— 1936. Culicidos de la Isla de Fernando Póo recogidos por la expedición J. Gil—F. Bonet. *Eos, Madr.* **11:** 311–329.

GILLETT, J. D., ROSS, R. W., DICK, G. W. A., HADDOW, A. J., & HEWITT, L. E. 1950. Experiments to test the possibility of transovarial transmission of yellow fever virus in the mosquito *Aëdes* (*Stegomyia*) *africanus* Theobald. *Ann. trop. Med. Parasit.* **44:** 342–350.

GOLD COAST SURVEY DEPT. 1949. *Atlas of the Gold Coast.* 5th edn. Accra.

GORDON, R. M. 1929. Identifications of biting flies from Mabang. *Rep. med. Dep. S. Leone* (1928): 85.

GOSSWEILER, J., & MENDONÇA, F. A. 1939. *Carta fitogeográfica de Angola.* Lisboa.

GRAHAM, W. M. 1911. *Rep. med. Res. Inst.* Nigeria (1910).

GRAINGER, W. E. 1947. The experimental control of mosquito breeding in rice fields in Nyanza Province, Kenya, by intermittent irrigation and other methods. *E. Afr. med. J.* **24:** 16–22.

GRANDIDIER, G. (Ed.). 1934. *Atlas des colonies françaises.* Paris.

GRÜNBERG, K. 1905. Zur Kenntnis der Culicidenfauna von Kamerun und Togo. *Zool. Anz.* **29:** 377–390.

HADDOW, A. J. 1942. The mosquito fauna and climate of native huts at Kisumu, Kenya. *Bull. ent. Res.* **33:** 91–142.

—— 1945*a*. On the mosquitoes of Bwamba County, Uganda. I. Description of Bwamba with special reference to mosquito ecology. *Proc. zool. Soc. Lond.* **115:** 1–13.

—— 1945*b*. The mosquitoes of Bwamba County, Uganda. II. Biting activity with special reference to the influence of microclimate. *Bull. ent. Res.* **36:** 33–73.

—— 1945*c*. The mosquitoes of Bwamba County, Uganda. III. The vertical distribution of mosquitoes in a banana plantation and the biting cycle of *Aëdes* (*Stegomyia*) *simpsoni* Theo. Ibid. **36:** 297–304.

—— 1948. The mosquitoes of Bwamba County, Uganda. VI. Mosquito breeding in plant axils. Ibid. **39:** 185–212.

—— 1950. A note on the occurrence of *Aëdes* (*Stegomyia*) *simpsoni* Theobald in the canopy of rain-forest in Bwamba County, Uganda. *Ann. trop. Med. Parasit.* **44:** 238–241.

—— & DICK, G. W. A. 1948. Catches of biting Diptera in Uganda with anaesthetized monkeys as bait. Ibid. **42:** 218–223.

—— GILLETT, J. D., & HIGHTON, R. B. 1947. The mosquitoes of Bwamba County, Uganda. V. The vertical distribution and biting-cycle of mosquitoes in rain-forest with further observations on micro-climate. *Bull. ent. Res.* **37:** 301–330.

—— & MAHAFFY, A. F. 1949. The mosquitoes of Bwamba County, Uganda. VII. Intensive catches on tree-top platforms with further observations on *Aëdes* (*Stegomyia*) *africanus* Theobald. Ibid. **40:** 169–178.

—— & VAN SOMEREN, E. C. C. 1950. A new species of *Stegomyia* Theobald from the Ruwenzori range, Uganda. *Ann. trop. Med. Parasit.* **44:** 281–284.

—— VAN SOMEREN, E. C. C., LUMSDEN, W. H. R., HARPER, J. O., & GILLETT, J. D. The mosquitoes of Bwamba County, Uganda. VIII. Records of occurrence, behaviour and habitat. (In press (*Bull. ent. Res.*).)

HANCOCK, G. L. R. 1930. Some records of Uganda mosquitoes and the oecological associations of their larvae. *Bull. Soc. R. ent. Égypte*: 38–56.

—— & SOUNDY, W. W. 1929. Notes on the flora and fauna of Northern Bugishu and Masaba (Elgon). *J. E. Afr. Ug. nat. Hist. Soc.* **36:** 165–183.

HARGREAVES, H. 1932. Annual report of the government entomologist. *Rep. Dep. Agric. Uganda* (1931), Pt. 2: 43–58.

HARRIS, W. V. 1942. Notes on culicine mosquitoes in Tanganyika Territory. *Bull. ent. Res.* **33:** 181–193.

HAWORTH, W. E. 1924. Mosquitoes and coconut palms. *Trans. R. Soc. trop. Med. Hyg.* **18:** 162–198.

HEISCH, R. B. 1947. Two years medical work in the northern frontier district, Kenya Colony. *E. Afr. med. J.* **24:** 3–15.

—— 1948. A parasitological survey of Taveta. Ibid. **25:** 78–94.

HEWER, T. F. 1934. Yellow fever in the Anglo-Egyptian Sudan. *Lancet,* **227:** 496–499.

HOANG-TICH-TRY. 1939. Essai de croisement de *St. albopicta* et de *St. fasciata* en espace restreint. *Bull. Soc. Path. exot.* **32:** 511–513.

HOCKING, K. S. 1947. The use of bamboo pots to indicate *Aëdes* prevalence. *Bull. ent. Res.* **38:** 327–333.

HOPKINS, G. H. E. 1936. *Mosquitoes of the Ethiopian Region. I. Larval bionomics of mosquitoes and taxonomy of culicine larvae.* London (Brit. Mus. (Nat. Hist.)).

HOWARD, C. W. 1912. Insects directly or indirectly injurious to man and animals in Mozambique, East Africa. *Bull. ent. Res.* **3:** 211–218.

HURST, H. E., & BLACK, R. P. 1943. *The Nile Basin,* **6.** Cairo.

INGRAM, A. 1912. Notes on the mosquitoes observed at Bole, Northern Territories, Gold Coast. *Bull. ent. Res.* **3:** 73–78.

INGRAM, A. 1919. The domestic breeding mosquitoes of the northern territories of the Gold Coast. Ibid. **10:** 47–58.

—— & DE MEILLON, B. 1927. A mosquito survey of certain parts of South Africa. . . . I. *Publ. S. Afr. Inst. med. Res.* **4:** 5–81 (No. 22).

—— —— 1929. II. Ibid. **4:** 87–170 (No. 23).

—— & MACFIE, J. W. S. 1917. The early stages of certain West African mosquitoes. *Bull. ent. Res.* **8:** 135–154.

INSTITUT ROYAL COLONIAL BELGE. 1950– . *Atlas général du Congo.* Bruxelles.

JANNONE, G., FERRO-LUZZI, G., & MARA, L. 1946. Risultati di una spedizione tecnico-scientifica nella Dancalia Settentrionale Esterna. *Boll. Soc. Ital. Med. Ig. trop.* (*Sez. Eritrea*). *Monogr.* **2.**

JOHNSON, W. B. 1919. Domestic mosquitoes of the northern provinces of Nigeria. *Bull. ent. Res.* **9:** 325–332.

—— 1920. *Annu. med. sanit. Rep. Nigeria* (N.P.).

JOHNSTON, J. E. L. 1916. A summary of an entomological survey of Kaduna district, Northern Nigeria. *Bull. ent. Res.* **7:** 19–28.

KARTMAN, L., NEWCOMB, E. H., CAMPAU, E. J., & MORRISON, F. D. 1947. Mosquitoes collected in Dakar, French West Africa, incidental to army malaria surveys. *Mosquito News,* **7:** 110–115.

KENNAN, R. H. 1915. Report of the senior sanitary officer. *Rep. med. Dep. S. Leone* (1914): 83–112.

KERR, J. A. 1933. Studies on the abundance, distribution and feeding habits of some West African mosquitoes. *Bull. ent. Res.* **24:** 493–510.

KUMM, H. W. 1931*a*. Studies on *Aëdes* larvae in South-Western Nigeria and in the vicinity of Kano. *Bull. ent. Res.* **22:** 65–74.

—— 1931*b*. The geographical distribution of the yellow fever vectors. *Amer. J. Hyg. Monogr. Ser.* **12.**

LAFACE, L. 1939. Diptera: Culicidae dell' Etiopia. *Rend. Ist. San. pubbl. Roma,* **2:** 939.

LAMBORN, W. A. 1930. The medical entomologist's report for 1929. *Annu. med. Rep. Nyasald.* (1929).

LEESON, H. S. 1931. Anopheline mosquitoes in Southern Rhodesia 1926–1928. *Mem. Lond. Sch. Hyg. trop. Med.* **4.**

—— & THEODOR, O. 1948. Mosquitoes of Socotra. *Bull. ent. Res.* **39:** 221–229.

LEWIS, D. J. 1943*a*. Mosquitoes in relation to yellow fever in the Nuba Mountains, Anglo-Egyptian Sudan. *Ann. trop. Med. Parasit.* **37:** 65–76.

—— 1943*b*. The culicine mosquitoes of Eritrea. *Bull. ent. Res.* **34:** 279–285.

—— 1945. Observations on the distribution and taxonomy of Culicidae (Diptera) in the Sudan. *Trans. R. ent. Soc. Lond.* **95:** 1–24.

—— 1947. General observations on mosquitoes in relation to yellow fever in the Anglo-Egyptian Sudan. *Bull. ent. Res.* **37:** 543–566.

—— 1948. The mosquitoes of the Jebel Auliya reservoir on the White Nile. *Bull. ent. Res.* **39:** 133–157.

—— HUGHES, T. P., & MAHAFFY, A. F. 1942. Experimental transmission of yellow fever by three common species of mosquitoes from the Anglo-Egyptian Sudan. *Ann. trop. Med. Parasit.* **36:** 34–38.

LIÉGEOIS, P. 1944. Fièvre jaune au Congo Belge. *Rec. Trav. Sci. Méd. Congo Belge,* **2:** 97–123.

MACFIE, J. W. S. 1916. *Rep. Accra Lab.* (1915).

—— 1917. Identifications of insects collected at Accra during the year 1916 and other entomological notes. Ibid. (1916): 67–75.

—— & INGRAM, A. 1916*a*. New culicine larvae from the Gold Coast. *Bull. ent. Res.* **7:** 1–18.

—— —— 1916*b*. The domestic mosquitoes of Accra. Ibid. **7:** 161–177.

—— —— 1923*a*. Certain nurseries of insect life in West Africa. Ibid. **13:** 291–294.

—— —— 1923*b*. The early stages of West African mosquitoes VI. Ibid. **13:** 409–442.

MACGREGOR, M. E. 1927. *Mosquito surveys.* London.

McHardy, J. W. 1927. Reports by the entomologist, medical and sanitary services, Tanganyika Territory. *Rep. med. Lab. Dar-es-Salaam* (1926): 13–29.

Mara, L. 1945. Considerazioni sul rinvenimento dell' *Aëdes aegypti* (Dipt. *Aëdinae*) ad altitudini d'eccezione e brevi note sulla fauna culicida del M. Bizen (Eritrea, A.O.). *Boll. Soc. Ital. Med. Ig. trop.* (*Sez. Eritrea*), **5:** 189–198.

Mattingly, P. F. 1947. Notes on the early stages of certain Ethiopian mosquitoes with some locality records from British West Africa. *Ann. trop. Med. Parasit.* **41:** 239–252.

—— 1949*a*. Studies on West African forest mosquitoes. I. The seasonal distribution, biting cycle and vertical distribution of four of the principal species. *Bull. ent. Res.* **40:** 149–168.

—— 1949*b*. Studies on West African forest mosquitoes. II. The less commonly occurring species. Ibid. **40:** 387–402.

—— Rozeboom, L. E., Knight, K. L., Laven, H., Drummond, F. H., Christophers, S. R., & Shute, P. G. The *Culex pipiens* complex. *Trans. R. ent. Soc. Lond.* (In press.)

Mayer, T. F. G. 1911. Notes on the blood-sucking flies of Oshogbo and Ilesha districts, Southern Nigeria. *Bull. ent. Res.* **2:** 273–276.

Mayr, E. 1942. *Systematics and the origin of species.* New York.

Moreau, R. E. 1933. Pleistocene climatic changes and the distribution of life in East Africa. *J. Ecol.* **21:** 415–435.

Mozambique Government. 1943. *Boletim mensal das observações meteorológicas feitas nos postas da Colónia.* Lourenço Marques.

Muspratt, J. 1945. Observations on the larvae of tree-hole breeding Culicini (Diptera, Culicidae) and two of their parasites. *J. ent. Soc. Sthrn. Afr.* **8:** 13–20.

—— 1950. Notes on *Aëdes* (Diptera Culicidae) from Natal, with a description of a new species of the subgenus *Stegomyia*. Ibid. **13:** 73–79.

Nash, T. A. M. 1948. *Tsetse flies in British West Africa.* London (H.M. Stationery Office).

Neave, S. A. 1912. Notes on the blood-sucking insects of Eastern Tropical Africa. *Bull. ent. Res.* **3:** 275–323.

Neveu-Lemaire, M. 1905. Mission du Bourg de Bozas, description d'une nouvelle espèce de *Stegomyia* recueillie par le Dr. Brumpt à Harrar. *Bull. Soc. zool. Fr.* **30:** 8–11.

Newstead, R., Dutton, J. E., & Todd, J. L. 1908. Insects and other Arthropoda collected in the Congo Free State. *Ann. trop. Med. Parasit.* **1:** 3–112.

Nixon, R. 1923. Coconut palms and mosquitoes. *Ann. sanit. Rep. Tanganyika* (1922), App. 2: 176–177.

Patton, W. S. 1905. The culicid fauna of the Aden hinterland, their haunts and habits. *J. Bombay nat. Hist. Soc.* **16:** 623–637.

Philip, C. B. 1929. Preliminary report of further tests with yellow fever transmission by mosquitoes other than *Aëdes aegypti*. *Amer. J. trop. Med.* **9:** 267–269.

—— 1931. List of mosquitoes collected in Nigeria, West Africa, incidental to research on yellow fever. *Proc. ent. Soc. Wash.* **33:** 44–47.

Pomeroy, A. W. J. 1920. The prophylaxis of malaria in Dar-es-Salaam, E. Africa. *J. R. Army med. Cps.* **35:** 44–68.

—— 1932. A report on the mosquito and tsetse problem at Takoradi. *Rep. med. sanit. Dep. Gold Cst.* (1930–1931): 101–118.

Portugal: Ministério das Colónias. 1948. *Atlas de Portugal Ultramarino.* Lisboa.

Pratt-Johnson, J. 1921. The distribution of malaria in South Africa and a mosquito survey of military hospital areas. *J. Hyg., Camb.* **19:** 344–349.

Rebelo, A., & Pereira, M. de C. 1943. Culicini (Diptera, Nematocera) da colónia de Moçambique. *Moçambique,* **34:** 81–90.

Rhodesian and Nyasaland Meteorological Service. 1950. *Climatological summaries: N. Rhodesia, July 1938–June 1948.* Salisbury.

Rhoudkhadzé, N. 1926. L'hibernation des Anophèles et des *Stegomyia* en Abassie (Géorgie Maritime). *Bull. Soc. Path. exot.* **19:** 480.

Riqueau, —. 1929. Les trous de crabes, gîtes à larves. *Bull. Soc. Path. exot.* **22:** 175–179.

ROBINSON, G. G. 1948. Mosquitoes caught in Northern Rhodesia at Balovale and Livingstone, *J. ent. Soc. Sthrn. Afr.* **11:** 63–67.

—— 1950. A note on mosquitoes and yellow fever in Northern Rhodesia. *E. Afr. med. J.* **27:** 284–288.

RODHAIN, J., & BEQUAERT, J. 1913. *Rapport sur les travaux de la mission scientifique du Katanga.* Bruxelles.

RUSSELL, P. F., & RAO, T. R. 1942. On relation of mechanical obstruction and shade to ovipositing of *Anopheles culicifacies. J. exp. Zool.* **91:** 303–329.

SCHINGAREW, N. I. 1927. Notes on Culicidae II. *Russ. J. trop. Med.* **5:** 545–550.

SCHWETZ, J. 1927*a*. Contribution à l'étude des moustiques d'Élisabethville et de quelques autres localités du Katanga. *Bull. Soc. Path. exot.* **20:** 170–192.

—— 1927*b*. Synopsis des moustiques connus du Congo Belge. *Rev. zool. afr.*, **15:** 271–319.

—— 1930*a*. Les moustiques de Stanleyville. *Ann. Soc. belge Méd. trop.* **10:** 1–41.

—— 1930*b*. Note préliminaire sur les moustiques de quelques régions de la Province Orientale. Ibid. **10:** 429–438.

—— 1938. Contribution à l'étude des moustiques de quelques localités du bas Congo et du Kwango. Ibid. **18:** 89–113.

—— 1942. Sur les moustiques du cours inférieur de la rivière Lomami (Congo Belge). *Rev. Zool. Bot. afr.* **35:** 323–327.

—— 1944. Recherches sur les moustiques dans la bordure orientale du Congo Belge. *Mém. Inst. R. col. belge* (Sec. Sci. nat. méd.), **14:** 3–93.

—— & CARTER, H. F. 1915. Preliminary notes on the mosquitoes of Kabinda (Lomami), Belgian Congo. *Ann. trop. Med. Parasit.* **9:** 163–168.

SCOTT, R. R. 1926. Report of the medical officer of health for Dar-es-Salaam. *Annu. med. Rep. Tanganyika* (1925): 41–53.

SÉGUY, E. 1924. Les moustiques de l'Afrique Mineure, de l'Égypte et de la Syrie. *Encycl. Entom.* Sér. A, **1.** Paris.

—— 1931. Contribution à l'étude de la faune de Mozambique. Voyage de M. P. Lesne 1928–1929. 3^{e} Note. Diptères (1re partie). *Bull. Mus. Hist. nat. Paris* (2), **2:** 645–656.

SENEVET, G. 1936. Notes sur les moustiques. IV. Quelques culicidés de la région de l'Aurès (Algérie). *Arch. Inst. Past. Algér.* **14:** 432–448.

SEYDEL, C. 1929*a*. Contribution à l'étude des moustiques du Congo Belge. Quelques moustiques du Katanga. *Rev. Zool. Bot. afr.* **18:** 28–31.

—— 1929*b*. Rapport entomologique pour la province du Katanga (Année 1928). *Bull. agric. Congo belge,* **20:** 228–237.

SICÉ, A., & VAUCEL, M. 1928. Études des gîtes à larves de moustiques à Brazzaville. Présence du *Stegomyia fasciata. Bull. Soc. Path. exot.* **21:** 768–770.

SIMPSON, J. J. 1912*a*. Entomological research in British West Africa. II. Northern Nigeria. *Bull. ent. Res.* **2:** 301–356.

——1912*b*. Entomological research in British West Africa. III. Southern Nigeria. Ibid. **3:** 137–193.

—— 1913. Entomological research in British West Africa. IV. Sierra Leone. Ibid **4:** 151–190.

—— 1914. Entomological research in British West Africa. V. Gold Coast. Ibid. **5:** 1–36.

—— 1918. Bionomics of tsetse and other parasitological notes in the Gold Coast. Ibid. **8:** 193–214.

SMITHBURN, K. C., & HADDOW, A. J. 1946. Isolation of yellow fever virus from African mosquitoes. *Amer. J. trop. Med.* **26:** 261–271.

—— HADDOW, A. J., & GILLETT, J. D. 1948. Rift valley fever; isolation of the virus from wild mosquitoes. *Brit. J. exp. Path.* **29:** 107–121.

—— —— & LUMSDEN, W. H. R. 1949. An outbreak of sylvan yellow fever in Uganda with *Aëdes* (*Stegomyia*) *africanus* as principal vector and insect host of the virus. *Ann. trop. Med. Parasit.* **43:** 74–89.

SOUTH AFRICAN DEPT. OF IRRIGATION. 1938. *Rainfall normals* (Met. Office, Pretoria, U.G.), **6.**

Stackelberg, A. A. 1937. *Faune de l'URSS. Insectes Diptères*, **3**, No. 4, *Fam. Culicidae* (*Subfam. Culicinae*). Moscow–Leningrad.

Sutton, E. 1942. Salivary gland type chromosomes in mosquitoes. *Proc. nat. Acad. Sci. Wash.* **28:** 268–272.

Symes, C. B. 1935. Insects in aeroplanes. *Rec. med. Res. Lab. Nairobi* (*Entom. sec.*), **6.**

—— & Roberts, J. I. 1937–1938. Reports of the section of entomology. *Rep. med. Res. Lab. Kenya.*

Tanganyika Territory Survey Divn. 1948. *Atlas of the Tanganyika Territory.* Dar-es-Salaam.

Taylor, A. W. 1930. The domestic mosquitoes of Gadau, Northern Nigeria, and their relation to malaria and filariasis. *Ann. trop. Med. Parasit.* **24:** 425–435.

—— 1934. A note on the mosquitoes breeding in tree-holes in Northern Nigeria. *Bull. ent. Res.* **25:** 191–193.

Teesdale, C. 1941. Pineapple and banana plants as a source of *Aëdes* mosquitoes. *E. Afr. med. J.* **18:** 260–267.

Theobald, F. V. 1901. *A Monograph of the Culicidae of the World*, **1.** London.

—— 1903. Report on a collection of mosquitoes or Culicidae, etc., from Gambia and a description of a new species. *Mem. Lpool. Sch. trop. Med.* **10,** App.: i–ix.

—— 1905. New Culicidae from India, Africa, British Guiana and Australia. *J. econ. Biol.* **1:** 18–36.

—— 1906. Report on economic entomology. Pt. 1, *Rep. Wellcome trop. Res. Lab.* **2:** 67–83.

—— 1907. *A monograph of the Culicidae of the world*, **4.** London.

—— 1909. Description of the new mosquitoes collected by Dr. Graham in Ashanti. *Colon. Rep. misc. Ser., Lond.* **237.**

—— 1910. *A Monograph of the Culicidae of the World*, **5.** London.

—— 1911*a*. Uganda Culicidae, including thirteen new species. *Novae Culicidae*, **1:** 9–35.

—— 1911*b*. The Culicidae or mosquitoes of the Transvaal. *Rep. vet. Res. S. Afr.* **1.**

—— 1912. A new species of Culicidae. *Rev. zool. afr.* **2:** 78.

—— 1913. New Culicidae from the Sudan. *Ann. trop. Med. Parasit.* **7:** 591–602.

Toumanoff, C. 1937. Essais préliminaires d'intercroisement de *St. albopicta* Sk. avec *St. argentea* Poiret. *Bull. Soc. méd.-chir. Indochine*, **15:** 964–970.

—— 1938. Nouveaux faits au sujet de l'intercroisement de *St. albopicta* Skuse avec *St. argentea* (*St. fasciata*) Theob. *Rev. méd. franç. Extr.-Orient*, **17:** 365–368.

—— 1939. Les races géographiques de *St. fasciatus* et *St. albopictus* et leur intercroisement. *Bull. Soc. Path. exot.* **32:** 505–509.

—— 1949. L'hémophagie variée et l'activité reproductrice chez *Aëdes aegypti* L. et *Aëdes albopictus* Skuse. Ibid. **42:** 466–470.

—— 1950. L'intercroisement de l'*Aëdes* (*Stegomyia*) *aegypti* L. et *Aëdes* (*Stegomyia*) *albopictus* Skuse. Observations sur la mortalité dans la descendance des générations hybrides F_1 et F_2 de ces insectes. Ibid. **43:** 234–240.

Vandenplas, A. 1943. La pluie au Congo Belge. *Mém. Inst. R. mét.* **16.**

Van Someren, E. C. C. 1946. Ethiopian Culicidae: notes and descriptions of some new species and hitherto unknown larvae and pupae. *Trans. R. ent. Soc. Lond.* **96:** 109–124.

Van Someren, G. R. C. 1943. Notes on the mosquitoes of British Somaliland. *Bull. ent. Res.* **34:** 323–328.

Wanson, M., & Nicolay, F. 1937. Biologie de *Culex fatigans* dans le Bas-Congo. *Ann. Soc. belge Méd. trop.* **17:** 111–122.

Wesché, W. 1910. On the larval and pupal stages of West African Culicidae. *Bull. ent. Res.* **1:** 7–50.

White, M. J. D. 1949. Cytological evidence on the phylogeny and classification of the Diptera. *Evolution*, **3:** 252–261.

Whitfield, F. G. S. 1939. Air transport, insects and disease. *Bull. ent. Res.* **30:** 365–442.

Wilbert, R., & Delorme, M. 1927. Sur un spirochétose ictérohémorragique du Chimpanzé transmissible à l'homme. *Ann. Inst. Pasteur*, **41:** 1139–1155.

WISEMAN, R. H., SYMES, C. B., McMAHON, J. C., & TEESDALE, C. 1939. *Report on a malaria survey of Mombasa.* Nairobi.

WOKE, P. A. 1937. Comparative effects of the blood of different species of vertebrates on egg production of *Aëdes aegypti. Amer. J. trop. Med.* **17:** 729–745.

WOLFS, J. 1946. Note sur les moustiques de Coquilhatville (Deuxième note). *Ann. Soc. belge Méd. trop.* **26:** 95–104.

—— 1949. *Aëdes* (*Stegomyia*) *apicoargenteus* var. *denderensis* var. n. (Culicidae). *Rev. Zool. Bot. afr.* **42:** 190–192.

ZEUNER, F. E. 1944. *Dating the past.* London.

ZUMPT, F. 1937. Stechmückenstudien im Pflanzungsgebiet des Kamerunberges. *Tropenpflanzer,* **40:** 366–383.

APPENDIX

SINCE going to press, a number of specimens have been received which are of so much interest from the point of view of distribution that they are felt to warrant special mention. The new records are as follows:

Aëdes apicoargenteus. TANGANYIKA. Ukara Island (B.M.).
Aëdes africanus. KENYA. Taveta (B.M.).
Aëdes dendrophilus and *Aëdes simpsoni.* B. CONGO. Elisabethville area (B.M.).

The records of *apicoargenteus* and *dendrophilus* are each based on a single incomplete female and are therefore subject to confirmation. Both specimens are, however, in quite good condition and agree so closely with the types that little doubt is felt as to their identity. Of the three records the most startling is that of *Aëdes africanus* of which several good specimens have been sent by Dr. Lumsden. Taveta has a mean annual rainfall of only 26 inches with five dry months and is thus far outside the limits so far recorded for *africanus*. The explanation, suggested to me by Dr. Haddow, appears to be the presence in this locality of 'dense, humid, evergreen forest' depending, not on rainfall, but on 'innumerable springs rising through the volcanic ash'. From this it is clear that the presence of *africanus* in this locality is dependent, not on the local rainfall, but on a subsoil water content conditioned by the rainfall some considerable distance away. It is tempting to infer from this that the 40 inches or so which are normally required are necessary rather for the maintenance of a suitable type of forest than for the provision of adequate supplies of water in the breeding-places. It must, however, be remembered that under the conditions described humidity will be high and temperature low, and evaporation from tree-holes within the forest will be correspondingly reduced. Accordingly the *effective* rainfall will be higher than in other localities where the actual rainfall is similar. Nevertheless it would seem that this most interesting discovery lends strong support to the belief, elsewhere expressed, that rainfall is primarily of importance for its indirect effect on vegetation. The Taveta population is quite clearly an isolated relict one comparing in this respect with those in the Sidamo Province of Abyssinia and, perhaps, in the Zomba area and adjacent parts of Mozambique.

The record of *apicoargenteus* from Ukara Island, for which I am indebted to Mr. Smith, extends the known distribution of the species in this area very much to the south. It does not in any way affect the empirical rainfall limits deduced from existing data, but it suggests the possibility of an interesting comparative study on seasonal distribution here and in the neighbouring border-line area around Mwanza.

The record of *dendrophilus* from Elisabethville, sent by Monsieur Lips, comes from far outside the known rainfall limits of the species. It seems that it may well be explained by the presence of extensive gallery forest in this region, in which case the record would be comparable with that of *africanus* from Taveta. Further details on this point are awaited from the collector, but it is known that *Aëdes chaussieri* and *masseyi* have recently been found in gallery forest in this area (Lips in litt. and specimen of *chaussieri* now in the British Museum). This record, if confirmed, would seem to render almost certain the presence of *dendrophilus* in the South Congo savannah as suggested above.

The record of *simpsoni* from the Elisabethville area does not appear to call for special comment.

BRITISH MUSEUM NATURAL HISTORY
PRESENTED
17 APR 1952

PRINTED IN
GREAT BRITAIN
AT THE
UNIVERSITY PRESS
OXFORD
BY
CHARLES BATEY
PRINTER
TO THE
UNIVERSITY

22 DEC 1952

A REVIEW, AND A REVISION IN GREATER PART, OF THE CTENISCINI OF THE OLD WORLD

(HYM., ICHNEUMONIDAE)

G. J. KERRICH

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. II, No. 6
LONDON: 1952

A REVIEW, AND A REVISION IN GREATER PART, OF THE CTENISCINI OF THE OLD WORLD (HYM., ICHNEUMONIDAE)

BY

G. J. KERRICH
(*Commonwealth Institute of Entomology*)

BRITISH MUSEUM
NATURAL HISTORY

Pp. 305–460; Pls. 4–7; 86 Text-figs.

BULLETIN OF
THE BRITISH MUSEUM (NATURAL HISTORY)
ENTOMOLOGY Vol. II, No. 6
LONDON: 1952

THE BULLETIN OF THE BRITISH MUSEUM (NATURAL HISTORY), *instituted in 1949, is issued in five series, corresponding to the Departments of the Museum.*

Parts appear at irregular intervals as they become ready. Volumes will contain about three or four hundred pages, and will not necessarily be completed within one calendar year.

This paper is Vol. II, No. 6 of the Entomology series.

PRINTED BY ORDER OF THE TRUSTEES OF
THE BRITISH MUSEUM

Issued December 1952 *Price Thirty Shillings*

A REVIEW, AND A REVISION IN GREATER PART, OF THE CTENISCINI OF THE OLD WORLD (HYM., ICHNEUMONIDAE)

By G. J. KERRICH

COMMONWEALTH INSTITUTE OF ENTOMOLOGY, AND HONORARY ASSOCIATE OF THE BRITISH MUSEUM (NATURAL HISTORY)

[Received for publication on 10 May 1951]

INTRODUCTION . . . 307
DESCRIPTIVE TERMS . . . 309
DISCUSSION OF SOME CHARACTERS, AND OF METHODS . . . 311
DISCUSSION OF GENERA . . . 313
KEY TO GENERA . . . 316
GENUS *ACROTOMUS* HOLMGREN . . . 319
GENUS *ANISOCTENION* FÖRSTER . . . 321
  Key to species of *Anisoctenion* . . . 350
GENUS *EXENTERUS* HARTIG . . . 354
  Key to species of *Exenterus* . . . 364
GENUS *EXYSTON* SCHIØDTE . . . 367
  Key to species of *Exyston* . . . 389
GENUS *PAREXYSTON*, GEN. NOV. . . . 392
GENUS *SMICROPLECTRUS* THOMSON . . . 393
  Key to species of *Smicroplectrus* . . . 412
GENUS *EUDIABORUS*, GEN. NOV. . . . 413
GENUS *CTENISCUS* (HALIDAY MSS.), CURTIS, THOMSON . . . 420
  Key to 'black-bodied' species of *Cteniscus* . . . 443
CONCLUSION . . . 451
SUPPLEMENT . . . 452
REFERENCES . . . 455
APPENDIXES . . . 458

SYNOPSIS

The systematic position and characters of the tribe are briefly reviewed, and there follow discussions of some descriptive terms and some characters used in this study. The genera are discussed from the points of view both of taxonomy and nomenclature, and a new key to genera is given, taking account of the Old World species and of those from the New World known to the author. The genera *Anisoctenion*, *Exyston*, *Smicroplectrus*, and the 'black-bodied' species of *Cteniscus* are fully revised, with descriptions of old and new species and with keys. Much fresh European information on the genus *Exenterus* is given, with a key to the Old World species. The remaining sections are less fully treated. Altogether two new generic names are proposed, and ten new species are described, with one new variety and one aberration named. Some new synonymy is given. The paper is illustrated by eighty-six text-figures and four plates.

INTRODUCTION

THE subfamily Tryphoninae, to which the Cteniscini belong, has recently been redefined by Townes & Townes (1949) to include all those ectoparasitic genera in which there is a large or rather large stalked egg, of which only the anchor passes down the channel of the ovipositor. The ovipositor (stylet) is not dorsally notched near the apex, or only occasionally weakly so. Thus the subfamily now includes the Ctenischini, Tryphonini, Sphinctini, Eclytini (= *Eclytus*+the 'Thymaridini') and a number of tribes mostly not included by the earlier authors; and it excludes not only the Metopiinae and Diplazoninae, but also almost the whole of the 'Mesoleptini' of authors. The steps leading to this position were reviewed by Kerrich (1942, pp. 64–65).

The Ctenischini differ from the other Tryphonine tribes, as from all other Ichneumonidae, in having the middle tibia with a single spur, and the hind tibia without a spur or with a very short one, much shorter than the apical breadth of the tibia where it issues. Usually the female of the species has more bright coloration than the male, whereas in Ichneumonidae generally the reverse is the case. They are most closely related to the genus *Polyblastus* of the Tryphonini, as recorded by Thomson (1883) and by Townes & Townes (1949).

As in other Tryphoninae, the female of the species is often to be found carrying an egg on the ovipositor. In the genera *Exyston* and *Smicroplectrus* the egg is often seen to be nearly or quite ready to hatch. This recalls the case of *Polyblastus* (see Kerrich, 1936), but only a single egg is carried at a time. It argues that a female individual must be long-lived to deposit all her eggs.

I have been able to see a vastly greater amount of material of this tribe than has ever before been studied by any one taxonomist in Europe; and the confidence with which species have been separated or synonymized, and the assessment made of the range of variation within species, could not have been attained in any other way. For the loan, or in a few cases the gift, of such material I am much indebted to Dr. Kjell Ander, Dr. L. Berland, Dr. J. G. Betrem, Dr. H. C. Blöte, Dr. Z. Bouček, Mr. H. Britten, Monsieur E. Cavro, Professor G. Ceballos, Monsieur A. Collart through co-operation of Dr. J. Leclercq, Mr. H. W. Daltry, Mr. E. A. Ellis, the late Dr. E. O. Engel, Dr. Ch. Ferrière, the late Professor Fr. Gregor, Mrs. F. H. Haines, Rektor K. Hedwig, Herr Gerd Heinrich, phil. Mag. W. Hellén, Mr. W. D. Hincks, Herr Rolf Hinz, Dr. R. Krogerus, Dr. Th. Kupka, Professor Dr. O. Lundblad, Herr B. Maixner, Dr. R. Malaise, Dr. L. Masi, Professor H. W. Miles, Mr. C. Morley, Lektor Å. Nordström, Mr. J. F. Perkins, the late Herra A. Saarinen, Dr. Erich Schmidt, Mr. A. W. Stelfox, Dr. H. G. M. Teunissen, Professor E. Tortonese, Rev. C. E. Tottenham, Dr. H. K. Townes, and Professor T. Uchida.

Outstandingly valuable to me have been the collection of the British Museum (Natural History), which I was also privileged to study before obtaining my present professional position, the Wesmael-Tosquinet collection of the Royal Natural History Museum, Brussels, and the collection of Mr. A. W. Stelfox. Dr. Th. Kupka's collection was especially helpful in the earlier stages of the work, as were specimens given me by Rektor K. Hedwig, which I could compare with Gravenhorst specimens and then retain. Dr. H. K. Townes and Mr. W. R. M. Mason have kindly lent me nearctic material, which has better enabled me to assess generic limits.

The material is mostly in the private collections of the persons mentioned, or in the museum collections of which they have charge, except that some specimens have now been presented to or exchanged with the British Museum (Natural History). The British Museum contains (apart from some British material sent in exchange to

Cambridge in 1931) the J. F. Stephens, T. Desvignes, T. A. Marshall, Ruthe, Buchecker, and R. von Stein collections; and all material here recorded as collected by Dr. R. C. L. Perkins, Mr. and Mrs. J. F. Perkins, Mr. and Mrs. R. B. Benson, and Mr. G. E. J. Nixon. Other Swiss material is mostly from the Geneva museum; while the Paris museum contains the collections of O. Sichel, J. Giraud, J. de Gaulle, and A. Seyrig. The specimens in the de Gaulle collection were mostly without determination labels, and so required re-identification.

I also wish to thank those who have received me in their homes, or in the museums of which they have charge. My visits to Breslau (Wroclaw) were made in 1936 and 1938, and the observations and lectotype selections here recorded were mostly made in the latter year.

I wish to express my particular gratitude to the late Dr. A. Roman, with whom my first real progress in the study of the Ichneumonidae, particularly the Tryphoninae, was made; to Mr. J. F. Perkins, whose incisive comment has frequently illumined the passage of this work; and to Mr. W. R. M. Mason, who is revising the nearctic species, for his co-operation in matters of mutual concern.

Herr Rolf Hinz kindly suggested my incorporating his observations on the biology of three of the species (two of which he had already identified), and was so good as to add that, so placed, they would be most readily found by future workers.

I am indebted to Mr. R. B. Benson for much information on the sawfly hosts of these insects, and on problems of distribution.

I wish to thank Dr. T. H. C. Taylor for reading my manuscript and advising on a number of points, and Mr. N. D. Riley for discussing with me the complicated problems of nomenclature.

Text-figures 1 to 5 and the four beautiful plate figures were drawn by Mr. Arthur Smith, and I wish to express my appreciation of the artist's skill in executing them.

In so far as material studied was captured on an expedition to Finland in 1935, this paper is a result of that expedition, of which the author's costs were defrayed equally by the Royal Society and by the Balfour Managers (Cambridge).

DESCRIPTIVE TERMS

It has been my constant endeavour to avoid descriptive terms that are morphologically inaccurate (e.g. 1942, pp. 43–45). Despite advancing knowledge the difficulty remains, however, that it is still not possible to delimit all morphological areas; and, in any case, the entities of taxonomic significance do not always correspond with the morphological entities. The following points seem to call for comment in introducing this paper.

Considering the facial aspect of the head, writers on Ichneumonidae have termed that part between the median ocellus, eyes, and antennae the 'frons', and that part between the antennae, eyes, and clypeus the 'face'. In 1942 it was proposed to follow Pratt (1940) by substituting 'postfrons' and 'antefrons' respectively: actually, however, Pratt restricted the term 'antefrons' to the more or less raised, median part, and excluded the orbital regions (parafrontals). After consultation with other specialists working in the British Museum (Nat. Hist.), I now use the terms 'upper face' and 'lower face' respectively, and retain 'epistoma' as part of the latter.

The term 'genal costa' is retained as applied by earlier authors (Thomson, 1873), but 'oral costa' is replaced by the more appropriate 'hypostomal costa' (Michener, 1944). These structures are of particular importance in the Cteniscini.

It was pointed out in 1942 (pp. 43–44) that earlier authors ignored the annellus at the base of the antennal flagellum, and the practice was then started of including it in reckoning the number of flagellar segments. The objection is that it is not always clearly defined in the Braconidae, and it is uncertain whether it should be regarded as a separate segment or as a secondary specialization. I have now agreed with J. F. Perkins to treat the flagellum as having a basal segment composed of an annellus and a postannellus: these, then, together constitute the first flagellar or third antennal segment. An analogous case is that of the trochanterellus, which is regarded by morphologists as a specialized basal part of the femur.

The pair of ventrally placed plates of the prothorax were thought by earlier workers to represent a divided prosternum (Pfankuch, 1919). O. W. Richards, in a paper on the Sphecoid genus *Trypoxylon* (1934), termed such plates the proepisterna; but he tells me it is uncertain whether this is morphologically accurate throughout the higher Hymenoptera, and it seems safer to call them the propleura. It is well known that in higher Hymenoptera the true prosternum is greatly reduced and usually largely concealed.

The main plate of the mesonotum, anterior to the scutellum, was simply termed the mesonotum by earlier workers. A nearer approach to accuracy is now achieved by calling it the mesoscutum, but it must be realized that it includes the mesoprescutum. This last is supposed by some workers to be the area between the notaulices; but this interpretation cannot be regarded as proven and, in any case, such area is not defined posteriorly.

Snodgrass (1935) introduced the term 'notaulices' as being etymologically more correct than 'notauli', and the present writer adopts this change and also substitutes 'sternaulices' for the old 'sternauli'. The ventral plate of the mesothorax, between the sternaulices, is still termed the mesosternum; for it is necessary to refer to this area, whether it corresponds with the true mesosternum or not.

The 'scutellum metathoracis' has been called by most British systematists the 'postscutellum', a term employed in a different sense by morphologists. The structure is here referred to as the 'metascutellum'.

It has long been realized that there are two body-segments between the mesothorax and the waist; and the use of the term 'propodeum' (or 'propodaeon') for the true first abdominal segment is well-established practice. It may, however, be worth pointing out that the 'area pleuralis', though treated with the propodeum in taxonomic descriptions, seems really to belong to the metapleuron (Pratt, 1940).

The term 'gaster' is again used to include the whole of the body posterior to the propodeum (see Kerrich, 1940*b*), and thus corresponds exactly with the 'abdomen' of earlier authors. It was termed the 'metasoma' by Michener (1944).

As has been pointed out to me, the 'ovipositor sheaths' (*Bohrerklappen* of German authors) do not always sheath the ovipositor. I continue to refer to these structures as the 'third valvulae' (Snodgrass, 1935), although this term is not in general use among systematists, and although it has also been pointed out to me that they are not morphologically equivalent to the first and second valvulae.

The term 'nervellus' is applied here, as by most authors, to a transverse vein of the hind wing; and reference is made in descriptions to where it is intercepted by a longitudinal vein above, below, or about in the middle. Morley (1903) applied this term to the longitudinal vein; but he changed this practice in his four succeeding volumes.

The trochanterellus is treated as a separate entity and, in descriptions, is not included in either the trochanter or the femur.

DISCUSSION OF SOME CHARACTERS, AND OF METHODS

Just as, in the main, the terms used in this paper follow those of previous authors, so, in the main, do the characters used in describing species and in separating them; though the attempt is always made to improve the precision with which they are used. Two sets of characters, however, appear to be quite new, and a third set has been greatly developed in comparison with previous work. Some characters are found to be more variable and therefore less valuable than has often been supposed.

It has already been stated that the form of the genal and hypostomal costae is of particular importance in the Cteniscini; and indeed this may apply to the whole form of the gena. The use of these characters was begun by C. G. Thomson and A. Roman; but they did not carry them very far. Recently Townes & Townes (1949) have found them of use, particularly in the genus *Monoblastus*. They did not, however, illustrate them; nor did they find such striking differences as are now disclosed in palaearctic *Exyston* and the two genera most closely related to it. Palaearctic *Smicroplectrus* must be considered as in the majority of cases indeterminable if the hinder gena cannot be viewed.

The shape of the antennal scape does not seem to have been studied previously. This varies to some extent, as do other characters; but I find it of such taxonomic value that the European species of *Anisoctenion* and *Exyston* could almost be determined on their antennal scapes alone. The differences in *Exenterus* are of lesser degree, though very serviceable; but in *Smicroplectrus* there seems to be greater variability, and I cannot use them for diagnosis except in one species.

The development of a pair of piliferous lobes on the anterior angles of the metanotum, recalling the cenchri of sawflies, has not previously been recorded. They are well developed in species of *Exyston* and *Smicroplectrus* studied; whereas in *Cteniscus* and in *Diaborus* auctt. they are represented by much weaker, simple projections, which may to a lesser degree be piliferous. To this extent the character has been used as an aid to generic diagnosis. The same structures are developed in *Exenterus* species, though not so strongly as in *Exyston* and *Smicroplectrus*. Intermediate stages are to be found in *Acrotomus* and *Anisoctenion* which, in this respect, are less consistent than the other genera mentioned.

Holmgren (1858) used the presence or absence of an 'apical' fovea on the scutellum (i.e. as distinct from the normal basal scutellar fovea) three times in the course of his dichotomous key to the species included in *Exenterus*; and Schmiedeknecht followed by using it to separate two quite large groups of species in *Cteniscus*. The greatest weight assigned to this character was by Davis (1897), who based a new genus *Excavarus* upon an admittedly larger excavation than I have seen in any European insect. Walley (1937) has already discussed this matter, and has shown that *Excavarus* is not a valid genus. No doubt each species has its own measure of weakness of the cuticle of the disk of the scutellum, resulting in a tendency to buckling; and this tendency is sometimes mentioned in descriptions in the present work. It is necessary, however, to find quite other characters for use in dichotomous keys.

It was colour characters that were most used by the older authors to distinguish insect species. Although it has long been recognized that these did not provide a sufficient basis for species discrimination, it is my firm conviction that they should not be rejected out of hand. A colour difference between two forms, if consistent throughout an adequate series of specimens, may indicate that structural differences should be sought. It may often happen that, when two species have been placed in synonymy because they have been found to differ only in one or more apparently trivial colour characters, the synonymized species will have to be reinstated when structural differences have been discovered.

In the present work the coloration of the species has been studied almost as intensively as the structure. My conclusion is that each species, or sex of a species, has a colour pattern that is fundamentally consistent however much it may vary, firstly in the degree of development and the intensity of the brighter colours, secondly in the extent and intensity of infuscation, and thirdly in the intensity of the melanic pigment in the parts of the cuticle that are regularly black or blackish.

Colour characters, then, must be used with discretion. They vary with type of locality, and also quite independently of locality. A character very frequently used in the past has been the presence or absence of a large apical pale mark on the scutellum. This proves consistent in the separation, as good species of *Cteniscus*, of two forms that previously have been treated as varieties; yet such mark may be absent or quite distinct within another species of *Cteniscus* and also within one of the new species of *Smicroplectrus*. When the coloration of a species has been investigated with the aid of adequate material, it can be seen which colour characters are sound, and can be used as additional means of distinguishing the species. When that stage has been reached, it also becomes possible to give probable interpretations of older colour diagnoses, as has also been done in the present paper.

Where proportions are quoted in descriptions, they have been calculated from micrometer measurements. It is surprising how difficult it is to estimate length to breadth accurately by eye, and allowance should on this account be made for possible inaccuracy in older descriptions. The proportions of the petiolar segment have been measured in most of the specimens from which descriptions and redescriptions have been made, particular care being taken not to overlook extreme cases. Proportions of the radial cell have been measured on a fair sample of the specimens, the others then being compared with these.

Figures are drawn from female specimens unless the contrary is stated.

The synonymic tables are not intended to be complete, and for some species are not given at all. References are given in all cases where the synonymy is new, or has been confirmed by reference to the types; and also in some cases where this is desirable to explain current usage, or where the reference is recent, or contains information to which attention is particularly drawn.

For locality records, the island of Ireland is treated as a single zoo-geographical unit. For other countries the boundaries taken are those that existed in 1937, as in most cases these give the country in which the locality was when the recorded specimen was captured. No political implications should be attached to this procedure.

DISCUSSION OF GENERA

The genus *Anisoctenion* was, as noted by Schmiedeknecht (1911), founded by Förster for species differing from *Acrotomus* in having the clypeus broadly apically rounded and the claws strongly pectinate. He adds that the first character is not sufficient to separate the genera, for the last three species placed in *Acrotomus*, i.e. *rubiginosus* Grav., *binotatus* Thoms., and *parvulus* Thoms., have the clypeus more rounded than truncate; and that, if the second difference is insufficient, then *Anisoctenion* can be united with *Acrotomus*. Certainly this second difference is insufficient, for a number of species placed in *Acrotomus* by Schmiedeknecht have the claws more or less strongly pectinate. However, the form of the clypeus is very characteristic in the *lucidulus—succinctus* group. I propose to restrict the genus *Acrotomus* to this group, and to transfer all the other species generally placed in *Acrotomus* to the genus *Anisoctenion* (see below), though *laetus* Grav. may perhaps be considered as a transitional species.

Viereck (1912) designated *lucidulus* Grav. as genotype of *Acrotomus* Hlgr. 1858, but Schmiedeknecht (1911) gives *lucidulus* Hlgr. = *succinctus* Grav. If *lucidulus* Hlgr. is not the same species as *lucidulus* Grav., then *lucidulus* Grav. was not an originally included species, and Viereck's type selection would be invalid. As Roman has already pointed out (1914, 1917), Holmgren had these two species mixed. Roman and I have since (1939) examined Holmgren's specimens, and find that all those of *lucidulus* Grav. are referable to Holmgren's varieties 2 and 3. We selected female and male lectotypes of *lucidulus* Hlgr., specimens from Småland, and these are *succinctus* Grav. as given by Schmiedeknecht.[1]

The genera *Exyston* and *Smicroplectrus* have been treated by authors as though very distinct. *Smicroplectrus* has, at least in Europe, been treated as though its species were scarcely to be distinguished except by colour differences, and it was not until 1913 that it was noted by Roman that *quinquecinctus* Grav. has the genal and hypostomal costae strongly elevated as in *Exyston*. It has not previously been noted that *quinquecinctus* Grav. has the epicnemial carina elevated, though much less strongly than in that genus, and that *pratorum* Woldst. (= *brevipetiolatus* Thoms.)

---

[1] The difficulty that arises over the identity of the type species of *Acrotomus* is due to the misidentification of a species. Such cases were considered by the International Commission on Zoological Nomenclature at its Paris meeting in 1948 (1950, *Bull. Zool. Nomenclature* **4**: 158–159, 6th Meeting, minute 38). I therefore propose to invite the Commission to consider this case, and in the meantime to treat *Acrotomus succinctus* Gravenhorst (= *Acrotomus lucidulus* Holmgren, 1858, *non* Gravenhorst 1829) as the type species of the genus.

has vomeriform third valvulae and finely pectinate claws. The generic characters were found so to intergrade that it proved difficult to decide at which point the species should be separated into genera; in fact, it might have seemed more natural to place the whole series of species into one genus were it not that the extreme forms, *cinctulus* Grav. and *jucundus* Hlgr., would have so little in common. At one time I thought it would be better to restrict the genus *Exyston* to the species with long petiole and simple claws, and to transfer *pratorum* Woldst. to *Smicroplectrus*, which would become characterized by the short petiole and pectinate claws; but the discovery of the species which has proved to be *phaeorrhaeus* Hal., and the subsequent examination of *albicinctus* Grav., species largely intermediate between *genalis* and *pratorum*, dispelled this notion. It seems best to erect a new genus for *calcaratus* Thoms. This species has been studied independently, from two Finnish specimens, by Hellén (1944), who suggested that it might be better placed in a separate genus 'die in die Nähe von *Exyston* und *Smicroplectrus* zu stellen wäre', but did not mention the form of the hypostomal costa. Hellén referred to Schmiedeknecht, but the latter's suggestion (1912) was for a genus to contain *pratorum* as well as *calcaratus*.

Walley (1937) considers *Excavarus* Davis not to be a valid genus. He places *E. annulipes* Cress. in *Smicroplectrus* and *E. viticollis* Cress. in *Diaborus* auctt.

Hincks (1944) has most opportunely reopened the question of the status of the names *Ctensicus* (Haliday MSS.) Curtis and *Exenterus* Hartig, and the further question as to whether the two genera, as generally understood by authors, can be maintained as distinct.

It is necessary to dispose of the second question in the first place. As observed by Schmiedeknecht (1911), Holmgren (1858)[1] distinguished only three genera: all species not referable to *Exyston* or *Acrotomus* he placed in *Exenterus*. Förster's work (1868) was modified by Thomson (1883), who produced the first satisfactory table of genera. The citations of Dalla Torre (1901–1902) and of Viereck (1914) were, no doubt, derived more from a study of the literature than of the insects. Hincks, though himself an accomplished student of Ichneumonoidea, has purposely avoided duplicating my study of the Cteniscini, and his citations here and in the 'Check List' (Kloet & Hincks, 1945) are derived from his interpretation of existing literature. Morley (1911: 203) has united the two genera; but I have no hesitation in following Thomson's interpretation and maintaining them as distinct as, in particular, Roman, Schmiedeknecht, and Cushman have done.

Accepting, then, the two genera in the Thomsonian sense, we have to consider the status of the name *Ctensicus*. Hincks writes: 'Personally I am inclined to regard the genus *Ctensicus* as dating from 1832 (Haliday in Curtis), and *C. aurifluus* Haliday is therefore the genotype by original designation.' The same view is implied by Morley (1911: 204).

Haliday published diagnoses of his genus *Ctensicus* and of his three new species in October 1838. Westwood (1840) listed the species and selected *curtisii* Hal. as type. This species has been very little understood: in the present paper its identity is clarified but, as shown below, other events stand prior to its selection as type by Westwood, and earlier by Curtis (1837). It is at the present time reckoned as congeneric with *auriflus* Hal., but I do not regard it as typical of the genus as a whole. Curtis's selection was an evident oversight, for he had already stated that *auriflus* was the type, and in any case it was prior to the valid publication of the species then selected.

---

[1] Most authors incorrectly quote Holmgren 1855, the date on which this paper was communicated to the Academy. The paper actually appeared in two parts, one included in each of the two parts of the first volume of this series, being the parts issued for the years 1855 and 1856 respectively. The whole volume is dated 1858, which is now quoted as the date of publication.

It is from the second edition of Curtis's *Guide* (1837) that publication of *Cteniscus* Hal. has usually been dated. The genus is there listed (column 98) with the three species subsequently diagnosed (October 1838). Later authors, in thus validating the genus, were, no doubt, under the misapprehension that the diagnoses of the species had been published previously. It appears to me that the publication in Curtis's *Guide*, ed. 2, cannot be valid unless *auriflus* Hal. can be accepted, with its genus, as valid from 1832. This depends upon whether 'occurs on Willows from July to Sept.' can be accepted as a valid publication of the genus and species. As stated by Hincks (1944), the acceptance of this standpoint would leave the *status quo* undisturbed, and *Cteniscus* would take as genotype by original designation the species *auriflus* Hal., a distinctive species of the typical general form and colour prevalent in the genus.

Since these considerations were first committed to paper, it has been pointed out to me by W. R. M. Mason, who is studying the New World species of this tribe, that, if the publication of the species *auriflus* Hal. be not accepted as valid from 1832, the genus *Cteniscus* would nevertheless be validated on the same page by inclusion of the described species *sexlituratus* Grav., which was mentioned as type species by Stephens (1835: 231). We cannot know for certain what species this is until the genus to which it belongs has been adequately revised and a lectotype selection carefully made; for it is possible that Gravenhorst's series was mixed. But we can accept it from Pfankuch (1906: 92) that it is a *Diaborus* Först. Thoms. which, in these circumstances, would have to take the name *Cteniscus*.

The name *Diaborus* is also in question, for, as W. R. M. Mason and later G. Heinrich pointed out to me, the type is *sedulus* Woldstedt 1877 by designation of Viereck (1912). The collection from which this species was described is presumed to be in the Leningrad museum. Schmiedeknecht (1912: 2344) placed the species in *Cteniscus* Thoms. and stated that the male was unknown. My interpretation of the original description is that it was made from not less than one female and two males; and that, though it may refer to some species of *Cteniscus* Thoms. such as *marginatus* Thoms., it contains nothing to preclude *Exyston genalis* Thoms., which is redescribed in the present paper.

Much now depends upon whether *Cteniscus auriflus* Haliday 1832 can be considered as valid. In the hope that it can, I propose the name **Eudiaborus gen. n.,** with type *pallitarsis* Thomson 1883, for the genus characterized by Thomson (1883: 882, 885) under the name *Diaborus* Först. This name seems appropriate, seeing that Roman (1939) showed that Thomson applied Förster's name to the genus that author actually had.

If *auriflus* Hal. 1832 be rejected, then the name *Cteniscus* must be transferred to the genus *Diaborus* Först., Thoms. *non* Woldst., and take as type a species not yet clarified. In that case another name will be required for *Cteniscus* Hal. Thoms. Woldstedt's original material of *sedulus* would have to be examined and a lectotype selected in order to determine whether *Diaborus* Först. Woldst. were correct or not. *Anecphysis* Först., Schmiedeknecht (1911:2281; 1912:2343–2344) might have served, had not Davis (1897) misused the name for a synonym of one of his own species of *Exyston*. But W. R. M. Mason tells me that, from his study of the nearctic fauna, he finds that the species grouped under a certain other genus of Förster, having line priority over *Diaborus*, are not generically separable from *Cteniscus* auctt.; and herein lies a possible alternative solution of the problem.

Since going to press I see that Mason has now (1951 April: 227) published his acceptance of *Cteniscus* Haliday as valid from 1832, and has duly placed *Eridolius* Förster in synonymy with the genus used in this sense (type *Ct. aurifluus* Hal.). He earlier wrote to me (*in litt.*) that he would not regard *pygmaeus* Hlgr., type species of *Eridolius* Först., as a satisfactory type species of the whole genus as he now understands it.

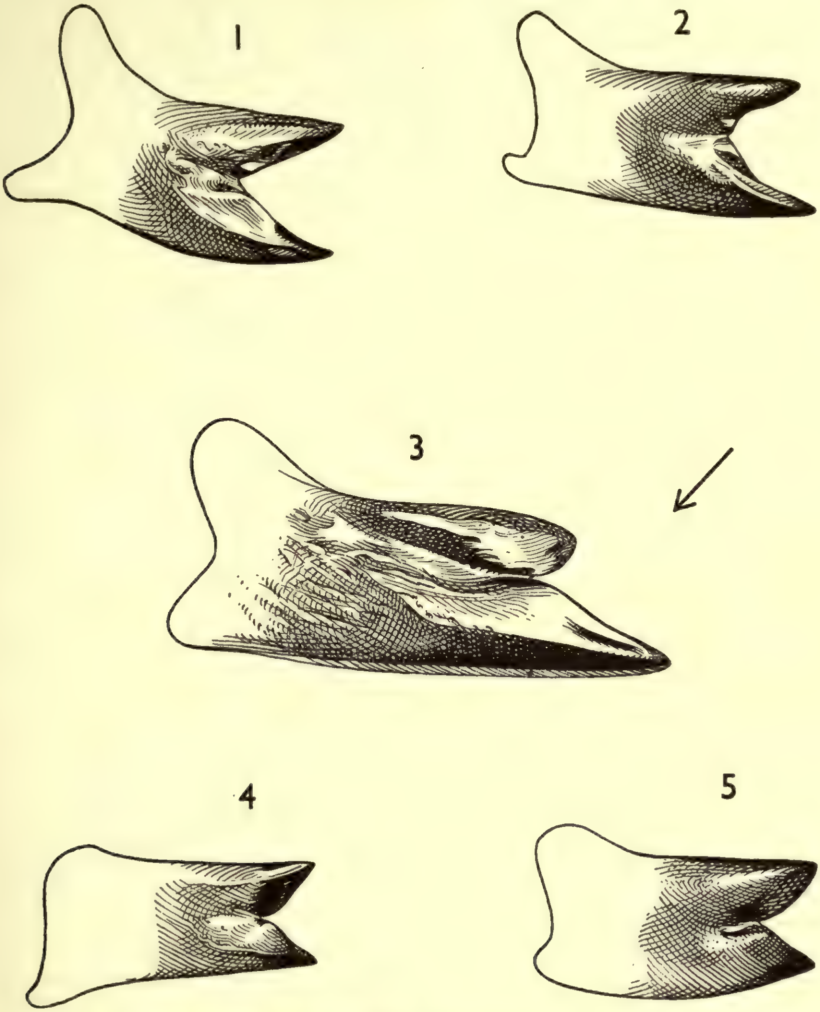
The action of Stephens (1835) in citing *Tryphon sexlituratus* Grav. 1829 as type of *Cteniscus* has never been followed, and to adopt this usage now would cause great confusion. All things considered, I propose to invite the International Commission on Zoological Nomenclature, by the exercise of their plenary powers, to set aside the citations by Stephens of *sexlituratus* Grav. and by Westwood and Viereck of *curtisii* Hal., and either to confirm *Cteniscus aurifluus* Haliday in Curtis 1832, or alternatively to select *aurifluus* Haliday 1838 as type species of *Cteniscus* Curtis 1832. Meanwhile I intend to continue the use of *Cteniscus* in that generally accepted sense.

Reasons are adduced below for placing all interpretations of *Picroscopus* in synonymy with *Exenterus*. It is also open to question whether '*Tricamptus*' *apiarius* Grav. merits generic separation; but, beside the distinctive appearance, there may be a biological difference in this case. The species of *Exenterus*, as that genus has recently been constituted, are all, so far as is known, parasites of Diprionidae, while *apiarius* has been recorded by Forsius (1911) as occupied with full-grown larvae of *Croesus septentrionalis* L. (Nematinae). I was prepared to maintain this species in a distinct genus so long as I believed such genus to have a valid name; but, as shown on another page, the name *Tricamptus* Först. must be applied to *pratorum* Woldst. (*Exyston*). I do not, however, think it opportune to propose a new generic name, and therefore replace the species in *Exenterus* where Schiødte and Holmgren had it.

KEY TO GENERA OF CTENISCINI

1. Lower mandibular tooth distinctly larger and more prominent than upper, and usually much longer (Figs. 1–3) 2
   Mandibular teeth sub-equal (Figs. 4, 5) 3
2. Clypeus almost pentagonal, not strongly transverse; apically sub-truncate or, rather, broadly and shallowly emarginate between the distinct apical angles (Figs. 6, 7) . . . . *Acrotomus* Hlgr.

Clypeus sub-elliptical, strongly transverse; apically more or less rounded, rarely at all emarginate and not apically angulate (Figs. 8, 9) *Anisoctenion* Först.

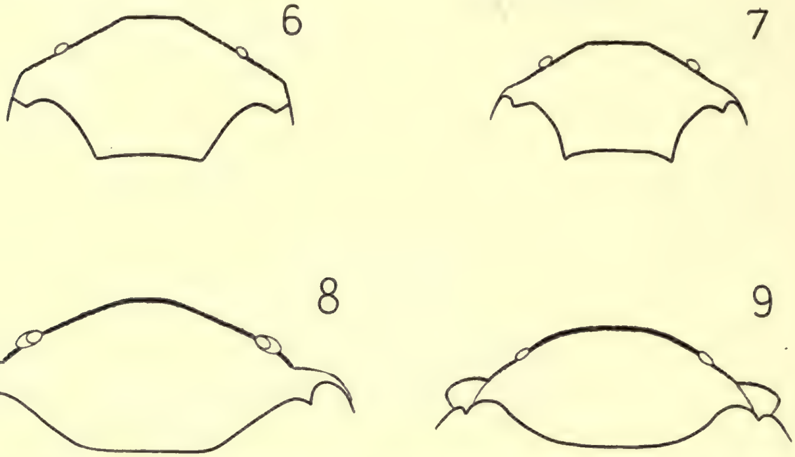


Figs. 1–5. Right mandible of Fig. 1. *Acrotomus succinctus* Grav. Fig. 2. *Anisoctenion pumilio* Hlgr. Fig. 3. *Anisoctenion triangulatorius* Grav. Fig. 4. *Cteniscus gnathoxanthus* Grav. Fig. 5. *Cteniscus aurifluus* Hal. Drawn by Mr. Arthur Smith. As indicated by the arrow, the direction of illumination for these five figures is half right, not half left.

3. Area superomedia transverse, generally distinctly so: body rather coarsely, and for the most part closely punctate; in particular, the vertical region and temples of the head are more or less coarsely punctate: hind tibia without, or with a very minute spur, much shorter than one-third the breadth of the tibia where it issues: propodeum and first two segments of gaster usually distinctly rugose

(Pl. 4): gaster generally thick-set and often broadly bright yellow-banded . . . . *Exenterus* Hartig

Area superomedia very seldom transverse: body rather finely, and generally for the most part sparsely punctate; in particular, the vertical region and temples of the head are more or less finely punctate: in case of doubt the hind tibia almost always bearing a short spur, whose length is about one-third the breadth of the tibia where it issues: propodeum and first two segments of gaster usually coriaceous or shining (Pls. 5, 6, 7), at most partly finely rugulose, or very seldom in large part distinctly rugose: gaster generally not thick-set and not broadly bright yellow-banded 4



Figs. 6–9. Clypeus of Fig. 6. *Acrotomus lucidulus* Grav. Fig. 7. *Acrotomus succinctus* Grav. Fig. 8. *Anisoctenion laticeps* Grav. Fig. 9. *Anisoctenion alacer* Grav.

4. Body strongly hairy: hypostomal costa almost always strongly raised: metathorax with anterior angles raised to form a pair of piliferous lobes (recalling the cenchri of sawflies). Hind tibia often bearing a short spur: genal costa and epicnemial carina strongly raised in most non-spurred species 5

Body not strongly hairy: hypostomal costa not strongly raised: metathorax without such piliferous lobes. Hind tibia without a spur: genal costa and epicnemial carina not strongly raised. 7

5. Head and thorax rather coarsely and irregularly, and also somewhat sparsely, hairy: petiolar segment often markedly elongate and narrowed: epicnemial carina strongly raised: hind tibia without a spur in all known palaearctic species (Pl. 5) . . . . *Exyston* Schiødte

Head and thorax finely and regularly, and also more densely, hairy: petiolar segment not markedly elongate and narrowed: hind tibia with a short spur in most species (Fig. 62, p. 398) 6

6. Hypostomal costae curved inwards, almost meeting behind mouth-parts (Fig. 59, p. 393) . . . . *Parexyston* gen. n.

Hypostomal costae not nearly meeting behind mouth-parts: epicnemial carina sometimes distinctly, but never strongly raised . . *Smicroplectrus* Thoms.

7. Tergite II with a pair of well-defined diagonal impressed furrows at base . . . . *Eudiaborus* gen. nov.
Tergite II without such well-defined furrows 8

8. Fore wing with areolet closed . . *Ctenicus* (Hal. MSS.) Curt., Thoms.
Fore wing with areolet open . . . . . . *Eridolius* Först.

The above table of genera attempts to achieve, so far as possible, a natural classification. I maintain the opinion that a fuller understanding of the genera and species should precede the construction of a 'practical' key of a simpler and more artificial nature, designed for speedier identifications.

It will be seen that the separation of the genera is not such an easy matter as may appear at first sight. They are based on groups of species with striking combinations of characters, yet the species will not all fall easily into watertight compartments. The genera represent, rather, aggregates of species with the tendency to possess such combination of characters. In each main genus there are one or more species which approach the unspecialized *Ctenicus* type: *pumilio* Hlgr. in *Anisoctenion*, *pratorum* Woldst. in *Exyston*, *ictericus* Grav. in *Exenterus*, and *jucundus* Hlgr. in *Smicroplectrus*. Conversely, the male of *Ctenicus hofferi* Gregor approaches *Diaborus* auctt., while *Ct. unicinctus* Hlgr. is decidedly suggestive of *Acrotomus*.

Genus *ACROTOMUS* Holmgren

1858 *Acrotomus* Holmgren, *Svensk Vet.-Akad. Handl.* **1:** 222.

In this genus as now restricted (see pp. 313, 316) I can, at present, distinguish only two species, *lucidulus* Grav. and *succinctus* Grav.

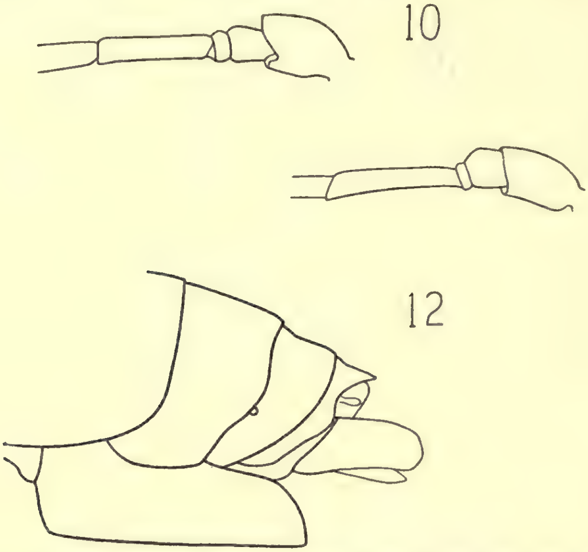
Roman (1914: 2–3) synonymized *sexcinctus* Grav. and *auriculatus* Thoms. with *lucidulus* Grav. An intensive study of large material from diverse localities should reveal whether any valid differences exist. My study of a number of very variable species within the tribe leads me to expect that all the material I have seen in this particular aggregate will fall within the range of variation of a single species; but at the present stage the concept is being left as that of an aggregate species.

Hellén (1941: 48) doubted the synonymy of *auriculatus* Thoms., and recorded under that name a male specimen which he characterized, and which he compared with *triangulatorius* Grav., a species that has not, till now, been well understood, at least under that name (see p. 323). He most kindly sent me this recorded specimen on loan, which has enabled me to establish that it does belong to the *lucidulus* aggregate.

The identity of *sexcinctus* Grav. Morley is also established in the present paper (see p. 336). See also my supplement, p. 452 below.

A. succinctus Grav. is abundantly distinct from the *lucidulus* aggregate, and can be recognized with the aid of the following table:

succinctus Grav.	*lucidulus* Grav. agg.
Clypeus (see Fig. 7)	Clypeus (see Fig. 6)
Antennae scarcely incrassate, with scape elongate and slender (Fig. 11).	Antennae distinctly incrassate, with scape shorter, stouter, and sharply incised (Fig. 10).
Notaulices extending to middle of mesoscutum, though indistinctly.	Notaulices generally short.
Petiolar segment without distinct basal lobes; less strongly transversely impressed in apical third.	Petiolar segment with basal lobes strong; more strongly transversely impressed in apical third.
Female hypopygium sharply folded mid-ventrally, at least in apical quarter.	Female hypopygium broader, not folded mid-ventrally, terminating in a short point.
Female third valvulae narrow in lateral and in ventral view; projecting strongly beyond apex of tergite 8 (Fig. 12).	Female third valvulae broad in ventral view, and densely hairy beneath; not or very little projecting beyond apex of tergite 8.
Male gaster clearly pale yellow in lateral view, before the reflexed lateral margins of the tergites.	Male gaster seldom pale yellow laterally, generally in ventral view only, apart from the hind margins of the tergites.



Figs. 10–12. Fig. 10. Left antennal scape and following segments, in sinistro-lateral view, of *Acrotomus lucidulus* Grav., drawn from a specimen compared with the type series in 1936. Fig. 11. The same of *Acrotomus succinctus* Grav. Fig. 12. Apical segments of gaster of *Acrotomus succinctus* Grav. in similar view.

Acrotomus lucidulus Gravenhorst

Pfankuch (1906: 93) states that there are two females in the Gravenhorst collection: this is correct if intended to exclude the 'varieties'. Of these two I select as lectotype the specimen in which the pronotum does not appear to have a continuous anterolateral yellow margin: the first in the collection. Pfankuch states 'Var. 2 fehlt', but, though not so labelled, two specimens are present.

I have specimens of this species compared with the Gravenhorst material in 1938.

Specimens of the aggregate species seen from England, Belgium, Norway, Sweden, Finland, Spain, France, Switzerland, and Germany. Also reliably recorded from Holland (Teunissen, 1948) and Czechoslovakia (Gregor, 1929).

Biology: ENGLAND, Beds., Luton, 1 ♂ em. vii.1940, *ex* larva of *Cladius difformis* Panz. (larva 20.vi.1940), V. H. Chambers. This confirms the records of Brischke and de Gaulle. Brischke's record of *sexcinctus* Grav. from the Danzig district, and of the breeding of it from *Hemichroa australis* Lep. (= *alni* auctt. *non* L.), quoted by Morley and Schmiedeknecht under *Acrotomus*, is very likely to refer to *Cteniscus curtisii* Hal. (see p. 426 below).

Acrotomus succinctus Gravenhorst

1829 *Tryphon succinctus* Gravenhorst, *Ichneumonologia Europaea*, **2**: 166–167 (*non Exenterus succinctus* Holmgren, 1858, see p. 421 below).

1883 *Delotomus lucidulus* Thomson, *Opuscula Entomologica*, fasc. 9: 884 (*non* Gravenhorst, 1829).

1906 *Acrotomus succinctus* Pfankuch, *Z. Hym. Dipt.* **6**: 94–95.

Mandible (Fig. 1).

In the Gravenhorst collection I select as lectotype the male specimen corresponding to the description of 'Individui prope Barterodam' (this locality is in Hannover province).

There is no doubt that Thomson's description refers to *succinctus* Grav., though there is also a female of the true *lucidulus* in his series from Pålsjö.

I have a pair of specimens given me by Rektor Hedwig and compared with the Gravenhorst material in 1938.

Specimens seen from Ireland (numerous, from several counties), England, Belgium, Sweden, Finland, France, Switzerland, Germany, Austria. Also reliably recorded from Holland (Teunissen, 1948) and Czechoslovakia (Gregor, 1929).

Genus *ANISOCTENION* Förster

1868 *Anisoctenion* Förster, *Verh. naturh. Ver. preuss. Rheinl.* **25**: 194.

Anisoctenion yakui Uchida

1932 *Acrotomus yakui* Uchida, *Ins. Mats.* **6** (4): 163+pl. v, fig. 12.

Female. Head moderately narrowed and rounded behind eyes; rather shallowly emarginate behind: on vertical region and temples moderately and rather closely punctate, sparsely so on genae except near mandibular base: upper face moderately, rather closely and sharply punctate in middle, more sparsely so at sides: lower face closely and rather coarsely punctate, with epistoma scarcely convex. Cheeks short and not at all buccate. Clypeus distinctly alutaceous, rather sparsely beset with punctures of mixed sizes, fine to coarse; sharply delimited basally; weakly convex; slightly impressed just before the moderately rounded apex. Malar space very short, less than half width of pedicellus below. Hypostomal costa weakly raised: genal costa scarcely raised, meeting it some way behind mandibular base, farther behind than distance between mandibular apices.

Antennae with scape (Fig. 26) rather elongate, moderately excised externoventrally; with postannellus 1·6 times length of following segment; with flagellum stout, filiform, 34-segmented.

Pronotum very little raised before dorsal transverse furrow which is narrow, irregular, and shallow; with epomiae very weak; laterally rather finely, shallowly and confusedly punctate above, longitudinally rugose below. Propleura finely and closely punctate. Mesoscutum moderately and rather evenly convex; with notaulices moderately impressed, not sharp but broad and finely rugose; moderately punctate discally, more finely so peripherally. Scutellum very strongly convex; margined to about middle, rather finely punctate except on elevated centre. Mesopleura closely and rather coarsely punctate below, moderately so anteriorly above, and with an extensive speculum: sternaulices broad but superficial: mesosternum almost flat, rather finely and closely punctate in front, finely and more sparsely so behind: mesolcus narrow and weakly impressed, closed behind: prepectus closely rugose-punctate: epicnemial carina very weakly raised. Propodeum long, scarcely raised from in front and not at all sharply declived; finely punctate above, obsoletely rugose behind; on area pleuralis rather closely punctate, rather finely so above, moderately so below: area posteromedia transverse but not strongly so, extending a good third the way forward, with a percurrent median costa: area superomedia narrow, very much longer than its greatest breadth, expanded to where it emits costulae before middle, not sharply delimited basally.

Petiolar segment 2·6 times length of its greatest breadth; almost regularly explanate from near base to near apex; laterally weakly margined, but with spiracular tubercles rather prominent; without distinct dorsal keels, but medially raised in anterior half and with a median impression behind; rather finely, closely and shallowly punctate. Tergite 2 with thyridia conspicuous, very little broader than long, and widely separated; finely and closely punctate in basal half: gaster more and more finely and sparsely punctate toward apex. Female hypopygium sharply folded midventrally. Female third valvulae rather narrow, with ventral margin slightly sinuate and decurved, projecting strongly beyond apex of tergite 8 (as in *triangulatorius* Grav., Fig. 15).

Fore wings with basal and disco-cubital veins parallel; with stigma and radial cell unusually elongate; with areolet sub-petiolate; with nervus parallelus emitted about in middle of brachial cell. Hind wings with nervellus slightly antefurcal, intercepted a little below middle.

Hind tibiae slender in about basal two-thirds, thereafter strongly expanded to apex. Tarsal claws moderately and rather regularly pectinate, but not to near apex of claw.

Length 9 mm.

Head black, with the following parts deep, bright flavous margined with fulvous: mouth-parts except mandibular apices, clypeus, lower face except for a median mark above, and a small mark between eye and mandibular base: clypeo-frontal suture dark. Antennae pale ferrugineous above, merging to fulvous in apical half; bright flavous below, merging to fulvous beyond post-annellus; with annellus and extreme base of postannellus pale all round. Thorax and propodeum black, with mark below fore wings and conspicuous marks on apical half of scutellum and on metascutellum bright flavous; with hind margins of scutellum and metascutellum obscurely pale: tegulae mainly stramineous. Fore and mid coxae, trochanters and trochanterelli pale flavous, the coxae dark at base: the remaining segments of these legs weakly rufescent: hind coxae, trochanters and trochanterelli flavous; with coxae at base and in part on outer side, and trochanters and trochanterelli above, blackish margined with fulvous: hind femora, tibiae and tarsi rufous, with the following blackened—femora weakly at base and above, tibiae more strongly above, and first four tarsal segments except at base and apex. Gaster with tergites 1 and 2 black, pale along hind margin and with a conspicuous pale spot near mid apex; with thyridia pale; with remaining tergites rufous, but tergite 3 infuscate in about basal half.

Redescribed from the holotype ♀ kindly sent me on loan by Professor Uchida: JAPAN, Hokkaido, Sapporo, ♀, 15.vi.1929, H. Yaku.

According to the original description, the male differs as follows—cheeks yellow: scutellum amd metascutellum yellow only at apex: hind coxae and femora almost black, the coxae yellowish at apex: gaster almost black, the tergites with pale apical margins.

In the general colouring, shape of head, form of clypeus, short malar space, stout flagellum, form of propodeum, petiolar segment, and female third valvulae this species appears most closely related to *triangulatorius* Grav.; but it differs in not having the hypostomal costa sharply raised nor the tarsal claws strongly pectinate. It shares with *ridibundus* Grav. and *pronotalis* nov. the character of having the hypopygium sharply folded mid-ventrally. For the cheeks to be yellow in the male but only with a small yellow spot between eye and mandibular base in the female is very peculiar in the Ctenisciini.

Anisoctenion triangulatorius Gravenhorst

1829 *Tryphon triangulatorius* Gravenhorst, *Ichneumonologia Europaea*, **2**: 205–206.
1835 *Tryphon mesoleptoides* Stephens, *Illustrations of British Entomology: Mandibulata*, **7**: 245, **syn. n.**
1858 *Acrotomus coarctatus* Holmgren, *Svensk Vet.-Akad. Handl.* **1**: 224–225.
1906 *Acrotomus triangulatorius* (Grav. *non* Hlgr., ♀ *non* ♂) Pfankuch, *Z. Hym. Dipt.* **6**: 222–223.

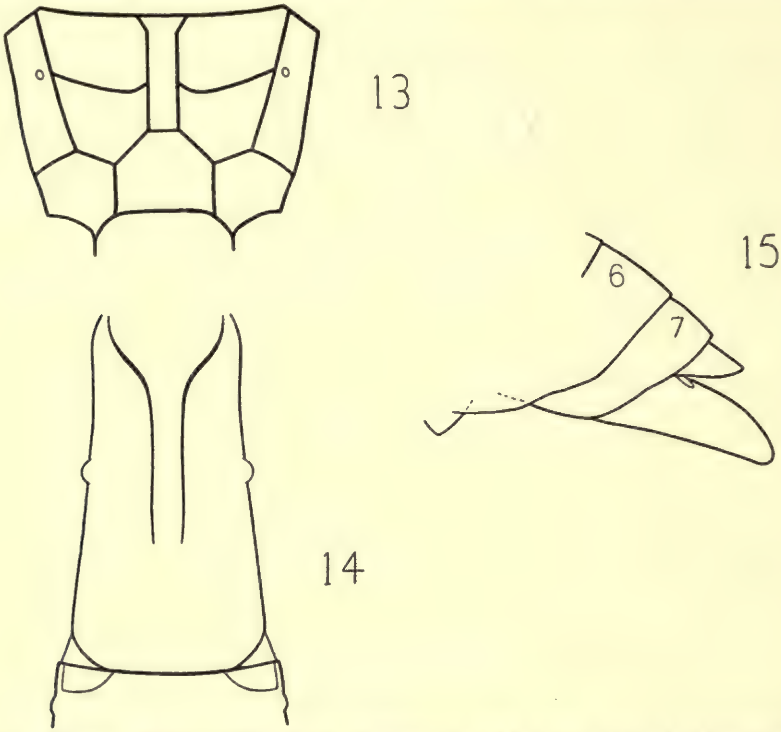
The following notes and description of *triangulatorius* Grav. and the freehand drawings (reproduced as Figs. 13–15) were made in Breslau in August 1938:

'I select as lectotype the specimen corresponding to Gravenhorst's colour description, a female, which is placed third in the collection. The allotype is placed eighth. Two other males in the collection differ from the above in having the propodeum rather shining; with strong costulae; with area superomedia not nearly parallel-sided: these would agree with specimens typically placed as *coarctatus* Hlgr.

'*Lectotype and allotype*:—Head slightly narrowed behind eyes, rather weakly emarginate behind. Vertex moderately finely and densely punctate, with strong impressions lateral to the lateral ocelli: face moderately coarsely and densely punctate, not shining. Clypeus coarsely punctate, apically sparsely so; very deeply delimited from face; apically almost truncate; moderately projecting when seen in side view. Lower mandibular tooth much longer than upper. Oral costa strongly raised where met by genal costa. Cheeks very short.

'Antennae with scape oval, scarcely one and a half times as long as broad; postannellus curved as in *laticeps* (Grav.) Thoms.

'Pronotum above and mesoscutum finely and densely punctate: pronotum coarsely longitudinally rugose below: notaulices moderately strongly impressed, reaching middle of mesoscutum. Scutellum moderately raised, not margined to middle. Mesopleura strongly punctate, with a large shining speculum: epicnemia slightly raised: mesolcus deeply impressed. Propodeum densely punctate and rather dull: area petiolaris finely rugose: area superomedia almost parallel-sided and almost three times as long as broad; costulae very weak.



FIGS. 13–15. Figures drawn freehand in Breslau in 1938 from type of *Anisoctenion triangulatorius* Grav. Fig. 13. Propodeum. Fig. 14. Petiolar segment, with base of following. Fig. 15. Apex of gaster, in sinistro-lateral view.

'Petiolar segment more than twice as long as broad; with prominent spiracles and moderately strong keels; strongly punctate and not shining except at apex. Thyridia large, about half width of space between them (very slightly foreshortened in figure). Third valvulae rather strongly projecting, strongly hairy.

'Radius curved at apex.

'Tarsal claws strongly pectinate in both sexes.'

I have compared with this description long series of specimens, principally in the British Museum and Manchester Museum collections, named as *mesoleptoides* Steph. or *coarctatus* Hlgr., including the type of *mesoleptoides* and can find no satisfactory separation.

Schmiedeknecht (1911: 2285) separated *triangulatorius* and *coarctatus* as follows:

Gaster black: segments 2 and 3 red or brown-red or blackish with red incisures. Propodeum with 5 distinct upper areae . . . . . *coarctatus* Hlgr.

Segments 1 and 2 or 1–3 black, their hind borders and the remaining segments red. Propodeum shining: costula absent or weak . . . *triangulatorius* Grav.

Habermehl (1925) recorded different specimens under the names *triangulatorius* and *coarctatus*, but there is no evidence that he ever compared them, and I do not know of any record published by Pfankuch under either of the two later names. Schmiedeknecht (1911: 2291) merely quoted Pfankuch's description of *triangulatorius*. In the L. A. Carr duplicate collection there is a specimen labelled as having been determined by Schmiedeknecht as *coarctatus*, but which would run down better in his key to *triangulatorius*: it agrees with my description of *triangulatorius* except for the shape of the area superomedia, which has the lateral costae strongly divergent from base to middle. Indeed, the area superomedia is seldom at all nearly parallel-sided, at least in English specimens: yet that is one of the characters that is variable. I have examined two female specimens from the same locality in Sweden (Skåne, Höör district, vi.1938, D. M. S. and J. F. Perkins) in which the area superomedia is to be described as very nearly parallel-sided: in one the costula is to be described as very weak, and in the other it is not. I now feel confident that we are dealing with a single species which is variable, *inter alia*, in the shape of the area superomedia, the strength of the areolation of the propodeum, the prominence of the keels and spiracular tubercles of the petiolar segment, the convexity of the scutellum and even, within the limits of its general form, of the shape of the clypeus.

The species is now described as follows.

Head slightly narrowed and rounded behind eyes, though sometimes more strongly so in smaller specimens; broadly and shallowly emarginate behind: vertical region and temples rather strongly and densely punctate, cheeks confluently so just above mandibular base: lower and upper face strongly and densely punctate, lower face almost confluently so just below scrobes, and upper face somewhat transversely rugose-punctate. Clypeus strongly transverse; coarsely punctate, sparsely so in lower half; very deeply delimited basally; with apical margin not broadly rounded but strongly depressed below the tentorial pits, and more or less nearly truncate in middle; not strongly convex, shallowly impressed before apical margin. Malar space very short, shorter than basal breadth of front metatarsus. Where met by genal costa, the hypostomal costa is strongly raised, often at an acute angle. Genal costa inflected: gena almost angulate behind lower base of mandible. Mandible with lower tooth very much longer and stronger than upper (Fig. 3).

Antennae elongate, not much attenuate to apex; with scape (Fig. 27) short, globose, weakly excised; with postannellus distinctly curved; with flagellum 32- to 36-segmented.

Pronotum with epomiae sharp and strong; behind them finely to moderately and rather closely punctate above, more or less strongly longitudinally rugose below. Propleura shining, shallowly and finely punctate, more coarsely so anteriorly. Mesoscutum normally convex anteriorly; with notaulices moderately, sometimes rather sharply, impressed; moderately punctate discally, more finely and densely so laterally and anteriorly. Scutellum not strongly convex; seldom margined to middle; very finely punctate at sides and almost impunctate above and behind. Mesopleura with a shining speculum; moderately punctate anteriorly above, strongly and, in part, almost confluently so below: sternaulices not deeply, though sometimes rather sharply impressed: mesosternum rather finely and densely punctate; prepectus rugose-punctate: epicnemial carina very slightly elevated: mesolcus narrow and sharply impressed, closed behind. Propodeum more or less finely punctate above, with area pleuralis more strongly so, rugose-punctate to finely rugose behind; with costae weak or rather weak, the hindmost the strongest, with costulae generally complete but sometimes more or less obsolete: area basalis not delimited apically: area superomedia sometimes more or less parallel-sided, more often distinctly contracted from middle to base: a triangular vestige of the area interna (Thomson, 1873, fasc. **5**, pl. fig. 16) is often present.

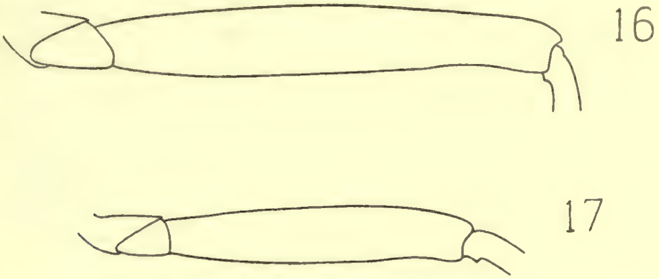
Petiolar segment elongate, 1·9 to 2·3 times length of its greatest breadth in female, 2·1 to 2·7 times in male; laterally sharply margined; with dorsal keels distinct to beyond middle, often strong; with spiracular tubercles more or less prominent; in basal half indeterminately rugose-punctate, in apical half rather strongly punctate, sometimes rugose-punctate; apically smooth and shining in middle. Tergite 2 with thyridia very distinct, not more than twice as broad as long. Remainder of gaster more and more finely punctate towards apex. Female third valvulae rather strongly projecting, decurved (usually more distinctly than is indicated by Fig. 15).

Fore wings with basal and disco-cubital veins parallel, or even slightly convergent to point of ramellus; with radius upcurved at apex; with areolet usually shortly petiolate but sometimes with a long petiole; with nervus parallelus emitted somewhat below middle of branchial cell. Hind wings with nervellus slightly antefurcal and intercepted below middle.

Legs rather slender, though with femora rather short (Fig. 17). Claws of all tarsi very strongly pectinate.

Length 7 to 11 mm.

Head black or blue-black, with the following parts deep bright flavous; occasionally paler: longitudinal marks near apices of genae, sometimes wanting, clypeus except marginally, and lower face with two large, triangular marks. These marks extend along the orbits and in one specimen are confluent below; but normally they reduce the black on the lower face to parts below the outer margins of the scrobes and a medial, more or less triangular part, which is often more nearly parallel-sided above. Mandibles pale stramineous, occasionally brighter, merging to almost black near apex. Palpi dull fulvous. Antennae with flagellum fulvo-testaceous, darker above towards base; with annellus generally entirely pale; with scape and pedicellus black above, below more or less obscurely pale in female and pale flavous in male. Thorax and propodeum black, with humeral angle of pronotum and occasionally a small mark below base of fore wing pale; with tegulae stramineous to pale flavous; with large apical marks of scutellum and metascutellum bright flavous. Legs of female with coxae and trochanters black or brownish, almost always pale at apex, except for the hind coxae which are generally totally black: fore and mid trochanterelli, femora, tibiae and tarsi dull flavous, the femora in large part nearer fulvous and the mid tarsi sometimes darkened: hind legs beyond the trochanters more or less rufous, sometimes paler, often almost black, especially above; hind tibiae, however, always pale flavous at base. The male differs in having the fore and mid legs flavous, except for the dark coxal bases, the femora scarcely tending to fulvous: the hind trochanterelli are more or less flavous. Wings with veins and stigma ferrugineous to deep fuscous, basally dull flavous. Petiolar segment black. Remainder of gaster varying from rufous, with the hinder tergites indefinitely infuscate in part, to black, with only the thyridia, broad margins of tergites 2 and 3, and very narrow margins of remaining tergites rufous, and the sternites mainly rufo-testaceous: typically tergites 2 and 3 and the genitalia are more or less rufous, and the male is the darker sex.



FIGS. 16–17. Left hind femur, in sinistro-lateral view, of Fig. 16. *Anisoctenion alacer* Grav. Fig. 17. *Anisoctenion triangulatorius* Grav.

Redescribed from the following material: IRELAND, Co. W. Mayo, Old Head, 1 ♂, 21.v.1942; Co. Wicklow, Devil's Glen, 1 ♀, 23.vi.1929, Glenmore Castle, 1 ♀, 16.vi.1934, Powerscourt Demesne, 2 ♂♂, 25.v.1932, on oak, Powerscourt Deerpark, 2 ♂♂, 27.v.1932, on oak, A. W. Stelfox: ENGLAND, unlocalized, 1 ♀, 2 ♂♂; Essex, Colchester, 1 ♀, 3.vi.1909, Harwood; Staffs., Lichfield district, 9 ♀♀, 6 ♂♂, L. A. Carr; Yorks., Grassington, 1 ♂, 19.v.1945, Beedale, 1 ♀, 9.vi.1945, W. D. Hincks: SWEDEN, Skåne, Höör district, 2 ♀♀, 2–17.vi.1938, D. M. S. & J. F. Perkins: CZECHOSLOVAKIA, Aussig on Elbe, 1 ♂, 18.v.1930, Th. Kupka.

The lectotype ♀ and allotype of *coarctatus* Hlgr., 'in Bahusia' (SWEDEN, Bohuslän), C. Boheman, have been compared and found to agree with the above description and a few of the specimens from which it was made.

Further material seen: ENGLAND, &c., 31 specimens in British Museum collection, including the Stephens type; Surrey, Dorking, Ranmore, 1 ♀, 18.v.1948, G. J. K.: BELGIUM, unlocalized, 2 ♂♂, C. Wesmael; Vivier d'Oie, 2 ♂♂, J. Tosquinet: HOLLAND, Venlo, Daeden, Plasmolen, 3 ♂♂, 4 ♀♀, H. G. M. Teunissen: FRANCE, Maisons Laffitte, St. Cloud, &c., 26.iv–29.v., J. de Gaulle; Haut-Rhin, Wattwiller, A. Seyrig (altogether 22 ♂♂, 10 ♀♀ in Paris Museum): GERMANY, material in Gravenhorst collection;

Stolzenau, 1 ♀, 13.v.1945, Hannover, 1 ♂, 14.v.1948, 1 ♀, 15.v.1948, R. Hinz; Schwerin, 1 ♂, 14.v.1882, 1 ♂, 17.v.1884, S. Brauns.

Biology. Herr Rolf Hinz has observed this species flying together with *Tryphon compunctor* Grav. from the beginning to the middle of May, and that both species parasitize larvae of *Apythemus serotinus* Müll. living on oak. He found the females hunting for larvae that had crawled into cracks in the bark or into the foliage for their last larval ecdysis.

Anisoctenion rubiginosus Gravenhorst

1829 *Tryphon rubiginosus* Gravenhorst, *Ichneumonologia Europaea*, **2**: 145.

1858 *Acrotomus insidiator* Holmgren, *Svensk Vet.-Akad. Handl.* **1**: 224 (placed in synonymy with *rubiginosus* Grav. by Pfankuch, 1906).

1858 *Exenterus morio* Holmgren, *Svensk Vet.-Akad. Handl.* **1**: 233 (placed in genus *Cteniscus* by Schmiedeknecht, 1912), **syn. n.**

1883 *Delotomus binotatus* Thomson, *Opuscula Entomologica*, fasc. 9: 886 (placed as a variety of *rubiginosus* Grav. by Gregor, 1929, by authorization of A. Roman).

1883 *Delotomus parvulus* Thomson, *Opuscula Entomologica*, fasc. 9: 886, **syn. n.**

1906 *Acrotomus rubiginosus* Pfankuch, *Z. Hym. Dipt.* **6**: 90–91.

1937 *Acrotomus binotatus* Hellén, *Notul. Ent.* **17**: 124 (*non parvulus* Hellén, 1941).

The following notes were made in Breslau in August 1938:

'*rubiginosus* Grav. I select the male specimen in the Gravenhorst collection as lectotype, as Pfankuch has already done by implication. In addition to the characters given by Schmiedeknecht, I have noted the following: head of female broadened behind eyes. Face with a strong longitudinal impression lateral to each scrobe: clypeus finely transversely impressed in apical half. Epicnemia moderately strongly raised, scarcely incised medially. Petiolar segment finely aciculate-punctate, scarcely shining, slightly broadened near base. Radialis II sinuate. Tarsal claws weakly and irregularly pectinate. Third valvulae finely hairy, with ventral margin sinuate, decurved.'

I do not think that anyone will quarrel with Roman's selection of a female lectotype of *insidiator* Hlgr.; nor with my own selection as lectotype of *binotatus* Thoms., from the three female specimens thus placed in the Thomson collection, of that one with best developed black spots on tergite 2 and most nearly sessile areolet. The situation regarding the other two names is more involved.

In the Swedish collection in the Stockholm museum stand the following specimens, all taken by Boheman and labelled *morio* Holmgren: 1 ♂ from Stockholm and 1 ♂ from Lapland, each labelled 'Typus', one ♂ from Stockholm labelled 'Allot.', and 1 ♀ from Lapland labelled 'Parat.' I think the male specimen from Stockholm labelled 'Typus' should be considered as the holotype. I believe that the transfer of *morio* Hlgr. from the genus *Cteniscus* has not previously been published; and I dissent from the opinion of Roman (1914: 16) regarding it.

In the Thomson collection, under *parvulus* Thoms., there stand two specimens. The second is a female from Farhult in Skåne, which I have determined as *pumilio* Hlgr.: it is evidently one of the specimens to which Thomson referred on p. 1255. It does not run to the species-group of *binotatus* in Thomson's key, and I reject it from consideration in this connexion.

The first specimen is a diminutive female, about 5 mm. in length, belonging to this species-group but labelled 'Scan' (= Skåne). The fourth and last specimen under *binotatus* is a male from Östergötland; it fits the diagnosis of *parvulus* about equally well, except that it is not notably smaller than the first three (female) specimens. I prefer to leave open, at the present time, the choice between either of these two specimens, or the possibility that the type is lost.

In all the material now examined, I can find very little divergence from the characters noted in Breslau. In some specimens the epicnemial carina is strongly incised medially: I should now describe it as strongly elevated between the sternaulices, in front of which a blunt angulation of the prepectus suggests a lateral closing of the coxal cavities. The sculpture of the petiolar segment I should now describe as rugulose-punctate, though the rugulosities are sometimes so regularly longitudinal as to suggest aciculation. The degree of development of the keels of the petiolar segment is decidedly variable. The decurving of the ventral margin of the third valvulae is less marked in smaller specimens. The diminutive female standing under *parvulus* in the Thomson collection is of lighter body-colour, and has the head appreciably narrowed behind the eyes, a condition that might be expected in an ill-nourished individual. But I cannot find any convincing specific separation. Having made the redescription given below, I feel satisfied that we are dealing with a single, variable species.

Head generally a little broadened behind eyes, particularly in female, in larger specimens strongly so; distinctly longer behind eyes than eye length seen from above; rather shallowly emarginate behind; strongly longitudinally impressed beside scapes; on vertical region and orbits finely or very finely punctate, grading to moderately or rather finely so on genae and epistoma; with upper face densely punctate. Clypeus very strongly transverse; finely to moderately and somewhat sparsely punctate; not deeply delimited basally; very weakly convex in basal half and somewhat impressed in apical half; very broadly rounded at apex. Malar space short but not very short, about equal to greatest width of pedicellus in side view in female, rather less in male. Where met by genal costa, the hypostomal costa is raised into a sharp or rather sharp tooth. Genal costa inflected: gena neither at all angulate nor much excavate behind lower mandibular base.

Antennae short, usually not much attenuate to apex; with scape short, weakly excised; with flagellum 24 to 30, usually 26- to 28-segmented.

Pronotum with dorsal transverse furrow rather strongly impressed and often transcostate at sides; with epomiae short; laterally finely to moderately and rather closely punctate above, more or less longitudinally rugose below. Propleura finely punctate and shining. Mesoscutum moderately or rather strongly convex; with notaulices short and weakly impressed; moderately punctate discally, finely to very finely so laterally and anteriorly. Scutellum finely to moderately punctate in front, finely so behind; in larger specimens almost flat above, often margined to beyond middle, falling almost perpendicularly behind; in smaller specimens more ordinarily shaped, but the same conformation suggested. Mesopleura closely and rather coarsely punctate, moderately so above and behind, often alutaceous in male, rugose by anterior margin and below wing-base: sternaulices broad, rather shallowly impressed: mesosternum very finely punctate: epicnemial carina extending about half-way up mesopleuron, strongly raised between sternaulices: prepectus moderately and closely punctate at sides, bearing traces of a pair of keels forming lateral margins to the strongly excavate coxal cavities: mesolcus strong and deeply impressed, closed behind. Propodeum rather short, sharply raised from behind; on area externa finely or rather finely punctate and on area pleuralis rather finely to moderately so, otherwise finely rugulose and rather shining, though occasionally rugose; with costae rather weak, the costulae very weak and usually incomplete, sometimes absent or scarcely indicated: area posteromedia not extending to middle: area superomedia rather elongate, generally strongly contracted from junction with costulae to base, seldom basally delimited.

Gaster of female spindle-shaped, of male more parallel-sided. Petiolar segment appearing rather short, of female 1·4 to 1·8 times, of male 1·5 to 2·2 times length of its greatest breadth; with distinct basal lobes, but with lateral margins not prominent; with dorsal keels weak, but often distinct for about three-quarters length of segment; finely or, more often, moderately punctate, usually in part rugose-punctate, very finely punctate behind. Tergite 2 with thyridia usually short, and in female inconspicuous: remainder of gaster more and more finely punctate. Female third valvulae projecting, with ventral margin decurved.

Fore wings with stigma broad; with basal and disco-cubital veins parallel or slightly convergent; with areolet petiolate to sub-sessile; with nervus parallelus emitted a little below middle of brachial cell. Hind wings with nervellus antefurcal, intercepted below middle.

Legs rather stout. Tarsal claws weakly pectinate, bearing a few weak comb-teeth near base.

Length 5 to 8½ mm.

Head black; with mandibles, except at apex and sometimes at base, and palpi flavous to ochreous; with clypeus usually castaneous at apex. Antennae with scape and pedicellus black or almost so, paler at apical margins; with annellus castaneous or paler; with remainder of flagellum fulvous to ochreous or darker below, darker, often mainly ferrugineous, above. Thorax black, with hind margin of mesopleura paler: tegulae stramineous or more white, occasionally darker. Legs mainly dull flavous to fulvous, more the latter; with coxae and trochanters black or almost so, pale at apex; with trochanterelli largely darkened; with fore and mid femora darkened near base and more extensively below, and hind femora black or almost so except at apex and extreme base; with hind tibiae more ferrugineous, especially below, or in male even darker, but always pale at base; with tarsi more or less darkened, and fore and mid tibiae occasionally darkened near base. Wings with veins and stigma ferrugineous or paler, basally dull flavous. Petiolar segment black, rufous at extreme apex. Remainder of gaster may be entirely rufous, occasionally castaneous, but is generally modified in the following ways: first, it is often more flavous beneath, and sometimes has ill-defined flavous hind margins of tergites: secondly, it is usually to a greater or lesser extent overspread with infuscation. Most frequently this is developed on tergite 2 as a median mark or as a pair of marks (the form described by Thomson as *binotatus*); but in darkest forms little remains pale in dorsal view but the thyridia and hind margins of tergites. Male gaster as thus described, but the darker forms relatively frequent.

Redescribed from the following material: ENGLAND, unlocalized, 1 ♂, 2 ♀♀, Desvignes coll. (♂ under *subnitidus* Grav., see Morley, 1911: 193); Devon, Dartmoor, Lustleigh, 1 ♀, 30.vi.1934, R. C. L. Perkins; Somerset, Bristol, Long Ashton, 1 ♂ em., 1.v.1935, *ex Cladius difformis* Panz. (Tenthredinidae), C. L. Walton (Kerrich, 1942: 63); Kent, Eynsford, 1 ♀, 6.vi.1939, G. E. J. Nixon; Wye, 1 ♂, 10–13.v.1949, Surrey, Byfleet, 1 ♂, 26–29.v.1949, Herts., Royston, 1 ♀, 24.v.1949, R. B. Benson; Cambridge, 1 ♂, v.1931, G. J. K., Gog-Magog Hills, 1 ♂, 19.v.1918, G. T. Lyle, Devils Dyke, 1 ♂, 5.vi.1925, H. T. Pagden; Yorks., Anstey, 1 ♂, 25.v.1930, J. W. Saunt, Grassington, 1 ♀, 19.v.1945, W. D. Hincks: BELGIUM, unlocalized, 6 ♂♂, 2 ♀♀, Diest, 1 ♂, 1 ♀, 1850, C. Wesmael; Arlon, 2 ♂♂, 20.v.1870, J. Tosquinet: SWEDEN, Skåne, Ringsjö, 2 ♂♂, 7.vi, 1 ♀, 12.vi, Höör district, 1 ♂, 13.vi, 1 ♀, 18.vi, Skäralid, 1 ♂, 3.vii.1938, D. M. S. & J. F. Perkins; Stockholm district, 2 ♂♂ (one the lectotype of *morio* Hlgr., the other labelled allotype), 1 ♀ (type of *insidiator* Hlgr.), C. Boheman; Lapland (southern), Tärna, 1 ♂, 18.vii, 1 ♀, 19.vii (paratypes of *morio* Hlgr.), C. Boheman: SWITZERLAND, Geneva, Peney, 3 ♂♂, 1886, 1 ♂, 9 ♀♀, 18.v.–13.vi, 1876–1889, Tournier; Valais, Ferpècle, 1 ♂, 21–27.vi, Arolla, 1 ♀, 30.vi, 1 ♀, 6.vii.1935, R. B. & J. E. Benson: GERMANY, unlocalized, 1 ♀, Ruthe coll.; unlocalized (probably Germany) 1 ♂, 1 ♀, O. Schmiedeknecht; Schladen, 1 ♀, 10.v.1946, Celle, 1 ♂, vi.1942, R. Hinz: CZECHOSLOVAKIA, Karov, 1 ♀, 9.vi.1907, coll. Holik; Trojacka, 1 ♂, 6.vi.1934, Brno, 1 ♀, 18.v.1937, Fr. Gregor.

Further material examined: ENGLAND, Surrey, Clandon Downs, 10 ♂♂, 8 ♀♀, 5–7.vi.1950, J. F. Perkins: HOLLAND, Tilburg, 1 ♂, 4.vi.1942, A. Adriaanse (coll. H. G. M. Teunissen under *parvulus* Thoms.): SWEDEN, material in Thomson collection (see above): FINLAND, Tvärminne, 1 ♂, L. v. Essen; Impilaks, 1 ♂, R. Forsius; Helsingfors, 1 ♂, W. Hellén: FRANCE, Maisons Laffitte, St. Cloud, la Bourboule, J. de Gaulle; Haut-Rhin, A. Seyrig (numerous specimens in mus. Paris): GERMANY, Holstein, Trittau, 1 ♂, v.1946, Bayrische Wald, Waldmünchen, 1 ♂, vi.1948, G. Heinrich: AUSTRIA, Styria, Admont district 1,200 m., 3 ♀♀, 11.vi–1.vii.1950, G. Heinrich.

Biology. Reared from *Cladius difformis* Panz. (Tenthredinidae) on strawberry (Kerrich, 1942: 63).

Anisoctenion pumilio Holmgren

1858 *Exenterus pumilio* Holmgren, *Svensk Vet.-Akad. Handl.* **1**: 240.
1888 *Cteniscus* (or *Delotomus*) *pumilio* Thomson, *Opuscula Entomologica*, fasc. 12: 1255.
1912 *Cteniscus pumilio* Schmiedeknecht, *Opuscula Ichneumonologica*, **5**: 2339–2340.
1929 *Acrotomus moravicus* Gregor, *Zprávy čsk. Stát. Reál. Gymn. Nové Jičín*, **1929**: 4 (separate pagination), *nomen nudum*, **syn. n.**
1941 *Acrotomus parvulus* Hellén, *Notul. Ent.* **20**: 48 (*non* Thomson, 1883).

Head (Fig. 18) strongly transverse; strongly narrowed behind eyes and rounded; shallowly emarginate behind: on vertical region and temples extremely finely punctate, usually near occiput and on genae clearly less finely so: with lower face finely, and upper face finely and closely punctate. Clypeus not strongly transverse; sparsely beset with punctures, rather fine to moderate; rather deeply delimited basally; distinctly projecting in side view, but weakly convex; apically broadly rounded, almost truncate; distinctly transversely impressed before margin. Cheeks short and not at all buccate, but in frontal view slightly concave. Malar space about two-thirds distance between mandibular apices. Hypostomal costa moderately raised to a very obtuse point, where it slopes strongly outward: genal costa distinctly raised, inflected. Mandible (Fig. 2).

Antennae filiform; with scape rather elongate, moderately excised externo-ventrally; with pedicellus abnormally elongate (Fig. 28); with flagellum 22- to 25-segmented.

Pronotum with dorsal transverse furrow narrow and irregular, but behind it in middle strongly shining; with epomiae of moderate strength, not curtailed below; behind epomiae extremely finely punctate above, rugulose or rugose below. Propleura very finely punctate, rugose anteriorly and by inner margin. Mesoscutum very strongly convex, rising sharply from pronotum, though almost flat discally; with notaulices moderately and rather sharply impressed; very finely punctate, closely so anteriorly. Scutellum rather weakly to strongly convex, often buckled; not margined to middle; falling rather sharply behind; extremely finely punctate, sparsely so discally. Mesopleura rather finely to finely punctate below, extremely finely so above, and with an extensive speculum: sternaulices broad and deeply impressed: mesosternum finely and not closely punctate, its halves notably convex: mesolcus of moderate width, deeply impressed, partly closed by a bituberculate ridge behind: prepectus rugose-punctate: epicnemial carina slightly elevated, sometimes almost complete. Propodeum short, curving strongly downward from base, and descending sharply from costulae; with costae of moderate strength; very finely, and for the most part closely punctate, only on and around area posteromedia conspicuously shining, sometimes rugulose behind spiracle: area superomedia distinctly longer than broad, nearly parallel-sided or a little expanded to costulae, not basally delimited: area posteromedia not extending to middle.

Petiolar segment 1·6 to 2·0 times length of its greatest breadth; almost regularly explanate from near base to very near apex in female; laterally distinctly but not strongly margined; with dorsal keels not strong, but distinct to rather near apex; finely or very finely punctate and finely rugulose beside keels, smoother between them, and with a median longitudinal depression between them on post-petiole. Remainder of gaster extremely finely punctate. Tergite 2 with thyridia conspicuous, short and broad. Female third valvulae in side view narrow, projecting strongly beyond apex of tergite 8, with ventral margin straight or almost so (Fig. 20).

Fore wings with basal and disco-cubital veins slightly divergent; with radius distinctly upcurved apically; with areolet sessile or sub-sessile; with nervus parallelus emitted below middle of brachial cell. Hind wings with nervellus slightly antefurcal, intercepted far below middle.

Tarsal claws not, or weakly and irregularly pectinate.

Length 5 to 6½ mm.

Head black, with mandibles, except near apex, and palpi stramineous: gena with a pale mark, stramineous or darker, at apical margin by lower articulation of mandible: clypeus with a broad, rather triangular mark, castaneous or paler, by the almost truncate middle part of the apical margin. Antennae with flagellum ochreous to rufo-ferrugineous, darker above than below: scape and pedicellus generally notably darker, but with their apical margins pale, as also annellus and extreme base of postannellus. Thorax and propodeum black, with the following parts paler: scutellum and metascutellum at apex and along hind margins, fore and hind margins of mesopleura, marks below tegulae, and hindmost angles of propleura: humeral angles of pronotum and tegulae stramineous: ventral margin (collar) of pronotum, more broadly in middle and at lower angles, distinctly or obscurely stramineous. Legs mainly fulvo-testaceous, with tarsi and hind tibiae darkened at apex, and hind knees sometimes darkened: hind tibiae otherwise paler: trochanters and trochanterelli, hind coxae at apex, and mid and fore coxae more extensively, stramineous. Wings with veins and stigma ochreous to ferrugineous, basally stramineous. Gaster with tergite 1 black, with tergites 2 and 3 sometimes almost black in basal half, and with remainder gradually paler towards apex, which is often almost ochreous; with apical margins of all tergites of female and some of male, and with thyridia, yellowish; with venter stramineous or darker.

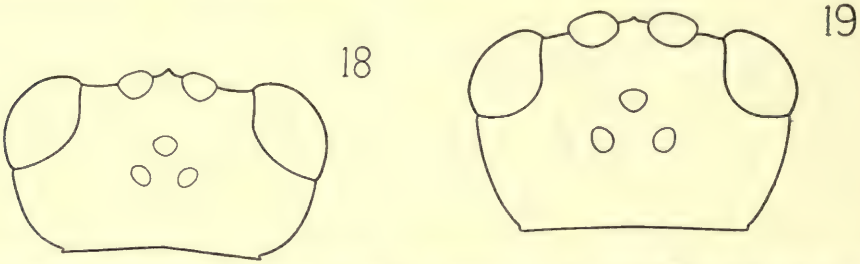
Redescribed from the following material: ENGLAND, NE. Yorks., Mulgrave Woods, 1 ♀, 3.v.1936, H. Britten; Westmorland, Witherslack, 1 ♂, 24.vi.1941, A. E. Wright: GERMANY, Bavaria, Görkau, 1 ♀, vi.1930, Th. Kupka; Silesia, Schillersdorf, 1 ♀, 1.ix.1935, 1 ♀, 4.ix.1937, Th. Kupka; unlocalized (probably Germany), 1 ♀, O. Schmiedeknecht: CZECHOSLOVAKIA, Moravia (unlocalized), 1 ♀; Moravia, Suchdol, 1 ♂, 27.viii. 1930, Fr. Gregor; Bohumin, Haatsch, 1 ♂, 28.viii. 1936, Th. Kupka: SWEDEN, Skåne, Höör district, 1 ♂, 11.vi, Ringsjö, 1 ♂, 19.vi.1938, D. M. S. & J. F. Perkins: FINLAND, Tavastia australis, Sääksmäki, 1 ♀, mid-vi.1921, W. Hellén (Hellén, 1941, under *A. parvulus* Thoms.); Hattula, 1 ♀, L. v. Essen.

Additional material seen: SWEDEN, Stockholm, type ♀; Skåne, 1 ♂, C. Boheman; Skåne, Farhult, 1 ♀ in Thomson coll. (Thomson, 1888: 1255) redetermined by G. J. K.: FRANCE, Mesnil, nr. Paris, 1 ♀, 19.vii.1891, J. de Gaulle: GERMANY, Hannover, 1 ♂, 21.viii. 1946, R. Hinz: AUSTRIA, Carinthia, 1 specimen, C. Boheman.

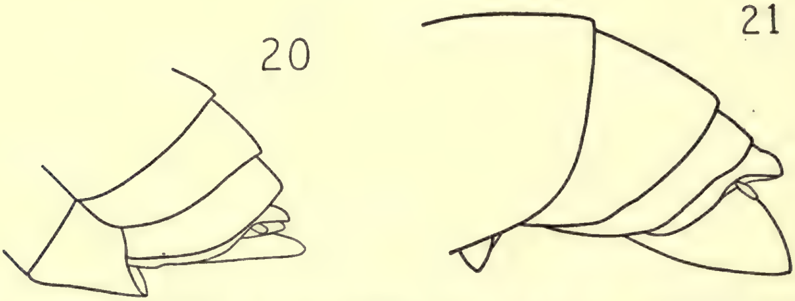
I examined the Holmgren type in 1939, and formed the opinion that the species should be transferred to *Anisoctenion*. Six days later, the Moravian pair was received in Manchester from Professor Gregor: they agreed with the diagnosis made and with my memory of the Holmgren type. The synonymy was confirmed by direct comparison in 1947.

Professor Gregor wrote to me that he had taken the species commonly in warm localities. He found there were great individual differences between different specimens and that, in smaller specimens, there was very little difference in length between the mandibular teeth. He regarded the species as a connecting link between *Acrotomus* and *Cteniscus*, but had not published a valid description lest one should already exist in an unsuspected place as, in fact, has proved to be the case.

In Schmiedeknecht's key to *Acrotomus* (**5:** 2284–2286) this species runs down with *alacer* Grav.; indeed, the Schmiedeknecht specimen in the British Museum collection was so determined by that author. *Pumilio* differs from *alacer* principally in having the head short, strongly narrowed behind the eyes; malar space much shorter than distance between mandibular apices; mesopleura finely punctate; sternaulices and mesolcus strongly impressed; gaster spindle-shaped in female; ovipositor sheaths strongly projecting (Fig. 20); tarsal claws scarcely pectinate; in having none of the features mentioned (p. 350) as special for *alacer*; and, of course, in the coloration and much smaller size and number of antennal segments. It has a much greater resemblance to a small specimen of *rubiginosus* Grav. which, however, has the head slightly broadened behind the eyes and the mesopleura rather coarsely punctate; and from which it can also be separated by the key characters.



FIGS. 18–19. Head in dorsal view of Fig. 18. *Anisoctenion pumilio* Hlgr. Fig. 19. *Anisoctenion alacer* Grav.



FIGS. 20–21. Apex of gaster, in sinistro-lateral view, of Fig. 20. *Anisoctenion pumilio* Hlgr. Fig. 21. *Anisoctenion laticeps* Grav.

Anisoctenion tenuis sp. n.

Head not so transverse as in *pumilio* Hlgr., but strongly narrowed and rounded behind eyes; moderately emarginate behind: on vertical region and temples finely and rather sparsely punctate; on genae finely or very finely and very sparsely punctate above, rather finely and much more closely so below; on upper and lower face moderately and closely punctate, more finely and sparsely so towards orbits. Clypeus as described for *pumilio* Hlgr., but less sparsely punctate and not sharply or at all deeply delimited. Cheeks and malar space as described for *pumilio* Hlgr.: hypostomal and genal costae also similar, but hypostomal weakly raised.

Antennae with scape stout, rather weakly but sharply excised externally (Fig. 29);

with pedicellus of normal proportions; with flagellum filiform and slender, 27- to 30-segmented.

Pronotum with dorsal transverse impression broad; with epomiae of moderate strength; laterally sparsely and very finely punctate above, finely reticulate to rugose below. Propleura shallowly punctate; finely and rather closely so by outer margin, elsewhere more coarsely and sparsely so. Mesoscutum not rising sharply from pronotum, but rather strongly and evenly convex, though flattened discally behind middle; with notaulices moderately and rather sharply impressed anteriorly, quite distinct to flattened part; finely and more or less sparsely punctate. Scutellum weakly convex and not falling sharply behind; sharply margined to beyond middle; finely and sparsely punctate discally, very finely and more closely so at sides and especially behind. Mesopleura rather finely to moderately, rather shallowly and sparsely punctate below, obscurely punctate anteriorly above: sternaulices broad and rather deeply impressed: mesosternum finely and not closely punctate: mesolcus of moderate width and moderately impressed, closed behind: prepectus finely rugose: epicnemial carina sharply though not strongly raised. Propodeum long and not at all sharply declived; with costae of moderate strength in front, stronger behind; for the most part very finely to finely punctate and elongately griseo-pilose: area posteromedia strongly transverse, extending barely a third the way forward; area superomedia narrow, very much longer than its greatest breadth, basally delimited but not sharply so, expanded to where it emits costulae before middle.

Petiolar segment very elongate and slender, 3·5 to 3·8 times length of its greatest breadth; laterally distinctly but not strongly margined, with spiracular tubercles prominent; with dorsal keels not strong, not reaching base and evanescent well before apex; finely and sparsely punctate beside keels behind spiracles; with sparse, elongate pilosity. Tergite 2 with thyridia distinctly broader than long; finely punctate in basal half: gaster more and more finely and sparsely punctate towards apex.

Fore wings with basal and disco-cubital veins nearly parallel; with areolet subsessile or sessile; with nervus parallelus emitted above middle of brachial cell. Hind wings with nervellus almost opposite, intercepted about in middle.

Tarsal claws very weakly pectinate.

Length 6 to 7 mm.

Head black, with mouth-parts except mandibular apices, and clypeus except marginally, pale flavous: clypeus deeper flavous in Burmese type. Antennae mostly flavous to base of post-annellus; beyond that dull fulvous to pale ferrugineous, distinctly darker towards apex. Thorax and propodeum rufo-ferrugineous to black; with ventral margin of pronotum, propleura, fore and hind margins of mesopleura, and hind margins of scutellum and metascutellum distinctly paler; with scutellum above and propodeum behind dull rufous in Burmese type. Legs mainly fulvous; with fore and mid coxae, trochanters and trochanterelli whitish, the coxae fulvous around base; with hind legs slightly darkened in part in Formosan specimen. Wings with veins and stigma ferrugineous; with stigma slightly and veins conspicuously paler at base. Gaster with tergite 1 rather ferrugineous except at mid apex, and with thyridia pale: remainder rufous in Burmese type but in Formosan specimen mainly infuscate, though with tergites dark rufous apically.

Described from the following material: NE. BURMA, Kambaiti, 7,000 ft., 1 ♂, 24.v.1934, R. Malaise (holotype): FORMOSA, Hassenzan, 1 ♂, 24.vi. 1934, L. Gressitt (paratype).

Holotype in Royal Natural History Museum, Stockholm: paratype in collection of Dr. H. K. Townes.

This species is clearly most closely related to the European *pumilio* Hlgr. The advance in knowledge of the taxonomy and distribution of the genus gained by describing the species is held to outweigh the disadvantage of having to do this from the male sex alone.

W. R. M. Mason has sent me a single female specimen of a species related to *pumilio* Hlgr. and *tenuis* sp. n., from a locality at a height of 3,500 ft. in the Nilgiri Hills in southern India. This is a further wide extension of the known distribution of the genus.

Anisoctenion ridibundus Gravenhorst

1829 *Tryphon ridibundus* Gravenhorst, *Ichneumonologia Europaea*, **2**: 188–189.
1906 *Acrotomus ridibundus* Pfankuch, *Z. Hym. Dipt.* **6**: 219.
1911 *Acrotomus sexcinctus* Morley, *The Ichneumons of Great Britain*, **4**: 197 (*non* Gravenhorst, 1829).

Head moderately narrowed behind eyes in female, more strongly so in male, and strongly rounded; rather shallowly emarginate behind: for the most part finely punctate, rather closely so above, sparsely so on most of gena; with lower and upper face moderately punctate, and generally with lower margin of gena densely and a little more coarsely so. Clypeus sparsely beset with punctures of mixed sizes, very fine to rather coarse; elongately pilose near apical margin; sharply delimited basally; strongly projecting in side view, but not strongly convex; not broadly rounded apically in female, though often rather so in male; and not or scarcely impressed before margin. Cheeks not at all buccate, but in frontal view slightly concave. Malar space of female about three-quarters distance between mandibular apices; that of male short, about equal to greatest width of fore metatarsus, seen from above near apex. Hypostomal costa rather weakly raised: genal costa scarcely raised, inflected.

Antennae relatively slender; with scape strongly convex interno-dorsally and weakly excised externo-ventrally; with pedicellus almost barrel-shaped, but more elongate than in *laticeps* Grav. (Fig. 30); with flagellum 26- to 29-, most usually 28-segmented; having the ultimate segment usually elongate, but sometimes imperfectly and sometimes fully divided (thus sometimes having a segment more in one antenna than in the other); and having some middle segments incurved externally as in *laticeps* Grav.

Pronotum with dorsal transverse furrow shining; with epomiae sharp but not strong; behind epomiae finely punctate above, rather strongly longitudinally rugose below. Propleura irregularly, rather finely and sparsely punctate. Mesoscutum strongly convex, rising rather sharply from pronotum; with notaulices weakly or moderately, seldom at all sharply impressed; finely punctate discally, less finely so peripherally. Scutellum strongly convex, and falling rather sharply behind; not margined to middle; finely to very finely punctate. Mesopleura moderately and not closely punctate below, finely, sparsely and irregularly so above: sternaulices broad, rather shallowly impressed: mesosternum finely to moderately and closely punctate, prepectus rather coarsely so: mesolcus sharply impressed, widening a little posteriorly, almost always well closed behind: epicnemial carina very slightly elevated, extending about half way up mesopleuron. Propodeum finely punctate above and on area pleuralis, elsewhere weakly rugose; with costae of moderate strength at sides and behind, usually weak and often incomplete above: area basalis excavate: area superomedia longer than broad.

Petiolar segment 1·6 to 2·0 times length of its greatest breadth; finely punctate above, but almost impunctate by hind margin; sharply but not strongly margined laterally; with dorsal keels not strong, but distinct to well beyond spiracles; not canaliculate between dorsal keels where these are distinct, but with a median depression behind. Remainder of gaster finely to very finely punctate. Tergite 2 strongly transverse; with a pair of broad, not sharply defined, furrows extending diagonally outward from base; with thyridia short, sharply impressed and conspicuous, about one-half breadth of intervening space. Female hypopygium sharply folded mid-ventrally. Female third valvulae rather broad, closely punctate; with ventral margin slightly sinuate but, on the whole, slightly upcurved; projecting well beyond apex of tergite 8.

Fore wings with basal and disco-cubital veins parallel or nearly so; with radius slightly upcurved at apex and slightly sinuate; with areolet sub-sessile; with second recurrent almost regularly arcuate; with nervus parallelus emitted a little below middle of brachial cell. Hind wings with nervellus slightly antefurcal, intercepted below middle.

Legs rather stout. Hind tibiae distinctly swollen before and very distinctly narrowed to base. Claws of all tarsi strongly or rather strongly pectinate.

Length 6½ to 9 mm.

Female. Head black, with the following parts flavous, with some fulvous margins: palpi, mandibles except at apex, clypeus, genae except broadly near occiput, and whole of lower face, except for a short median mark just below antennae. Antennae with scape and pedicellus dull flavous to rufous below, rufous to ferrugineous above; with annellus more or less rufous; with remainder of flagellum fulvous to testaceous, more or less ferrugineous near base. Thorax and propodeum black, with the following parts flavous, with some fulvous margins: scutellum at apex and metascutellum, humeral angles of pronotum and ventral margin rather broadly at sides, propleura mainly, marks below fore wings, tegulae, and metategulae in part; usually with the following parts more or less ferrugineous: fore and hind margins of mesopleura in part, lateral extensions of scutellum and metascutellum, and some margins of propleura; sometimes with paler marks beside mesolcus. Legs mainly fulvous, with hind tibiae decidedly paler at base; with fore and mid coxae, and all trochanters and trochanterelli, mainly stramineous to pale flavous, the mid coxae often flushed with fulvous; with hind coxae except at apex, and hind femora except narrowly at base and apex, dark ferrugineous. Wings with veins and stigma ferrugineous, paler at base. Petiolar segment black, sometimes dark ferrugineous towards apex. Remainder of gaster mainly dark ferrugineous above; with apex and sides and with thyridia fulvous; with slightly broad apical margins of tergites 2 and 3, usually with narrow margins of remaining tergites, and with most of venter paler.

The male differs as follows: genae with flavous coloration much more restricted, often only narrowly flavous by the mandibular articulation; clypeus with a pair of dark marks below tentorial pits; lower face with a broad, percurrent, median black band and with eye margins black for some distance below antennal sockets, the black margin sometimes curved inward towards tentorial pits. Propleura not pale-coloured except by hind margins. Hind tarsi and tibiae dark above, the latter conspicuously pale at base: fore and mid femora and tibiae often paler than in female. Gaster of darker appearance, scarcely fulvous at apex and only narrowly so at sides.

Redescribed from the following material: ENGLAND, Desvignes coll., 1 ♀ (previously twice misdetermined); Surrey, Abinger, 1 ♀, 18.viii.1947, G. J. K.: BELGIUM, unlocalized, Groenendael, Rouge Cloitre, 9 ♂♂, 7 ♀♀, Wesmael and Tosquinet coll.: SWITZERLAND, Grisons, Tarasp. 1 ♀, Ch. Ferrière: GERMANY, unlocalized (probably Germany) 1 ♂, O. Schmiedeknecht; nr. Berlin, 1 ♀, Ruthe coll.; Munich and other localities, 1 ♂, 20.vi, 1 ♂, 2 ♀♀, 16.vii. Buchecker coll.; Bavaria, Oberstdorf, Birgsau, 3 ♀♀, viii.1936, G. E. J. Nixon; Silesia, Ransern, 1 ♂, 1 ♀, 7.vi.1934, K. Hedwig: CZECHOSLOVAKIA, Bohemia, 1 ♂, J. Sekera; Breudeis, 1 ♂, coll. Salvator; Trojacka, 1 ♂, 6.vii.1928, Fr. Gregor.

The Silesian pair, kindly given me by Rektor K. Hedwig, was compared with the male type in Breslau in September 1936.

From the key to species and description given by Morley (1911) under *Acrotomus sexcinctus* Grav. I could tell that he had an *Anisoctenion*. In response to my request for the loan of one of the specimens taken by Capron, most probably around Shere in southern Surrey, Mr. Morley most generously gave me a male. This proved, as I had suspected, to be of this species, which has not before been properly recorded as British.

Further material seen: FRANCE, 5 specimens, Sèvres, St. Cloud, &c., 12.vi.–28.vii, J. de Gaulle: GERMANY, Göttingen, 1 ♂, 1 ♀, 14–19.vii, 1 ♀, 28.viii.1946, R. Hinz: AUSTRIA, Carinthia, 1♀, C. Boheman. See also supplement, p. 452 below.

Anisoctenion pronotalis sp. n.

Head distinctly broader than thorax, strongly transverse; slightly and almost rectilinearly narrowed behind eyes, then strongly rounded; moderately emarginate behind; in facial view strongly narrowed to mouth, with epistoma not strongly convex and with cheeks not at all buccate: with temples and cheeks rather finely punctate; with lower face rather coarsely, but at sides and near midline not densely so; with upper face broadly at sides moderately punctate: vertical region very finely punctate and upper face in middle almost impunctate. Clypeus not strongly transverse; sparsely beset with moderate punctures; basally distinctly but not deeply delimited; apically moderately rounded; in side view very weakly convex in basal, and almost flat in apical half. Malar space a little less than distance between mandibular apices. Hypostomal and genal costae sharply but not strongly raised, meeting not far behind mandibular base, at a distance of about twice their greatest height.

Antennae (Fig. 32) with scape rather elongate, not quite twice the length of its greatest breadth, moderately excised externo-ventrally; with postannellus unusually elongate, just twice the length of the following segment, both measured along inner margin; with flagellum 33- to 34-segmented, elongate, slender, and finely tapering.

Pronotum strongly raised before the sharply impressed dorsal transverse furrow; with epomiae strong but short; laterally very finely punctate above, very strongly shining below; with lateral margins at about level of epomiae suddenly expanded to produce broad flanges, which present a distinct ventral surface overhanging the propleura. Propleura shining and finely punctate. Mesoscutum normally convex, rather dull; with notaulices weakly impressed but traceable to disk; rather finely punctate, between tegulae and notaulices more coarsely and closely so. Scutellum rather flattened; with margins not at all sharp, yet percurrent, separating a hinder face from the sides, and weakly tuberculate at junction; moderately punctate above at base, impunctate on disk, very finely punctate on sides and behind. Mesopleura moderately punctate except on and before speculum: sternaulices rather strongly impressed: mesosternum almost flat, shallowly, but for the most part coarsely and very closely punctate: mesolcus narrow for more than half its length, then broadened and deepened, largely closed by an incised costa behind: prepectus with a pair of sharp keels which form lateral margins to the coxal cavities, and a pair of blunter outwardly directed keels. Propodeum with a conspicuous covering of elongate, silvery hairs; rather shining and, for the most part, very finely rugulose-punctate, but with the area pleuralis finely to moderately and closely punctate; with costae of moderate strength: area basalis not distinctly delimited apically: area superomedia elongate, greatly expanded to the costulae, which are emitted far before middle, decidedly narrow behind: area posteromedia not extending to middle.

Petiolar segment elongate, about 2·8 times length of its greatest breadth; not laterally margined through the spiracles, which are more or less prominent; with sharp basal auricles; rather strongly convex, but with dorsal keels scarcely indicated; smooth near mid line, moderately punctate at sides. Tergite 2 about as long as its apical breadth; with a pair of strong, though not sharply defined, diagonal impressed furrows at base; with thyridia large and conspicuous. Segment 3 of female with distinct epipleura margined to near apex. Female hypopygium sharply folded mid-ventrally. Female third valvulae rather broad, with ventral margin slightly upcurved: projecting strongly beyond apex of tergite 8.

Fore wings with stigma rather elongate and narrow; with basal and disco-cubital veins convergent; with radius upcurved at apex; with areolet sub-sessile; with second recurrent strongly sinuate; with nervus parallelus emitted about in middle of brachial cell. Hind wings with nervellus slightly antefurcal, and intercepted a little below middle.

Claws of all tarsi strongly pectinate from base to apex.

Length of female about 12½ mm., of male 11½ mm.

Head bluish-black, with the following parts bright flavous, narrowly margined with fulvous: mouth-parts except mentum and mandibular apices, clypeus, genae except near occiput, and lower face. Antennae with scape dull rufous above, with an infuscation near apex and extending along outer edge, flavous beneath; with pedicellus and annellus partly pale rufous, partly infuscate, paler beneath; with remainder of flagellum ferrugineous, paler beneath, towards apex, and at apices of basal segments and base of postannellus; with postannellus otherwise almost black above. Thorax and propodeum black, but with mesoscutum bluish-black like the head, and propleura inclining to ferrugineous; with flavous marks below fore wings: tegulae dull castaneous, in part dull flavous. Fore and mid legs with coxae and trochanters stramineous, the mid coxae to some extent infuscate behind; with femora more or less rufous, paler in front; with tibiae and tarsi pale rufo-testaceous: hind legs with coxae and trochanters castaneous, the trochanters and the coxae at extreme base dull stramineous beneath, the coxae also with paler marks above and below near base; with tarsi and apical fourth of tibiae rufous below, darker above, the tibiae in basal three-fourths pale beneath. Wings with veins and stigma ferrugineous, pale at base.

Gaster rufous; with tergite 1, except at apex, almost black; with tergite 2 dark at base except on thyridia.

The male differs in having the hind trochanters entirely, and trochanterelli in part, dull stramineous.

Described from the following material: NE. BURMA, Kambaiti, 6,000 ft., 1 ♀ (paratype), 1.vi.1934, R. Malaise; Kambaiti, 7,000 ft., 1 ♀ (holotype), 1 ♂ (allotype), 8.vi.1934, R. Malaise.

Holotype and allotype in Royal Natural History Museum, Stockholm: paratype in British Museum (Natural History).

The strongly pectinate claws and form of the female third valvulae place this species in the *laticeps* species-group. The elongate scape, strongly sinuate second recurrent vein, and general coloration relate it to *laticeps* Grav.; but it resembles *ridibundus* Grav. in having diagonal furrows on the second tergite and a sharply folded hypopygium. The flattened scutellum is reminiscent of *laetus* Grav., and the elongate petiolar segment also of *triangulatorius* Grav. The form of the prepectus is suggested in *rubiginosus* Grav., but that of the pronotum is quite novel among palaearctic Ctenisciini.

From Dr. H. K. Townes, through Mr. W. R. M. Mason, I have received a specimen with the following data: FORMOSA, Musha, 1 ♀, 21.v.1932, L. Gressitt. This differs from the above-described northern Burmese specimens as follows: hypostomal costa weaker, and genal costa almost absent, though a vestige is just discernible on left side of head. Flagellum 32-segmented. Pronotum laterally moderately punctate above and with epomiae not short. Scutellum of essentially similar form, but almost conical and sharply bituberculate, moderately rugose-punctate at sides, and with discal impunctate area greatly reduced. Punctation of area pleuralis and petiolar segment obscure. Diagonal impressed furrows of tergite 2 not discernible. Female third valvulae not so broad. Basal and disco-cubital veins very little convergent: areolet sub-petiolate. Length 10 mm. Head and thorax above a deeper black: pale colour of head a deeper, mustard-yellow: antennae almost unrelieved dull ferrugineous, apart from the castaneous annellus and extreme base of postannellus: tegulae darker: legs rather darker, in particular the mid coxae in greater part infuscate: tergites 2 more extensively and 3 at base weakly infuscate.

This form is so essentially similar to the northern Burmese specimens that I cannot regard it as specifically distinct. The differences in size and colour are less than are known to occur in other species within Europe, and the smaller number of flagellar segments and narrower third valvulae are clearly correlated with the smaller size. The form of the scutellum and obsolescence of the genal costa I regard as minor malformations: since I have seen specimens of *Smicroplectrus jucundus* Hlgr. with the genal costa incompletely developed, I can regard this as not indicating a specific separation. Moreover, Townes & Townes (1949: 408) record that, in *Monoblastus kaniacensis* Hall, the genal costa is usually obsolete but sometimes complete. These and other differences will indicate the range of variation to be sought, just as the record itself is a valuable indication of the distribution.

Anisoctenion laticeps Gravenhorst

1829 *Tryphon laticeps* Gravenhorst, *Ichneumonologia Europaea*, **2**: 214–215.
1883 *Delotomus laticeps* Thomson, *Opuscula Entomologica*, fasc. 9: 884.
1906 *Acrotomus laticeps* Pfankuch, *Z. Hym. Dipt.* **6**: 289.

The two specimens standing under this name in the Gravenhorst collection are not in very good condition. They are not *laticeps* Thoms. *et auctt.*, but were seen in Stockholm in 1939 and determined by A. Roman as *Cteniscus dorsator* Thunb. var. *punctipleuris* Thoms. The first specimen is a male; the second has the gaster broken off. As Rektor K. Hedwig observed in a letter to me, these do not agree with Gravenhorst's description, and cannot be reckoned as types. Pfankuch (1906) stated all too briefly 'die Type ist ein Weibchen'. It is, of course, not impossible that he made a mistake; but *laticeps* Thoms. agrees well with Gravenhorst's description. Rektor Hedwig wrote to me that he could not find anywhere in the collection a specimen which could be the type, which must be reckoned as lost. The interpretation of Thomson, as first reviser, has, therefore, been accepted.

A redescription of the species having been made in 1938 from Thomson's series and other material, a lectotype was accordingly selected in 1939, a female specimen from Pålsjö. In 1948 it was found necessary to revise the description to conform with the standard adopted in the present paper; but the lectotype, and a specimen from Örtofta designated allotype, are among the material from which the 1948 description has been made.

Head broadened behind eyes, generally very distinctly so; narrowly and rather strongly emarginate behind: on temples and cheeks moderately punctate, near occiput and malar space more densely so; with upper face very densely punctate; with lower face rather coarsely punctate, and on epistoma very densely so. Cheeks distinctly buccate. Clypeus strongly transverse; rather sparsely and rather coarsely to coarsely punctate; sharply delimited basally, with tentorial pits particularly conspicuous; apically broadly rounded (Fig. 8); moderately projecting in side view, and scarcely at all impressed before apical margin. Malar space about three-quarters distance between mandibular apices. Hypostomal costa weakly raised: genal costa scarcely raised, inflected.

Antennae (Fig. 33) with scape abnormally elongate, more than twice the length of its greatest breadth, moderately excised externo-ventrally; with pedicellus almost barrel-shaped; with post-annellus rather strongly curved externally and some middle segments distinctly so; with flagellum 28- to 32-segmented, rather stout, explanate to about two-thirds its length and thereafter tapering to apex.

Pronotum with epomiae not strong; finely punctate before and rather finely to very finely punctate behind them; with longitudinal rugosities below rather weak to very weak or virtually absent. Propleura shallowly, but generally somewhat coarsely punctate, much more finely so near outer margin; strongly rugose anteriorly and by inner margin. Mesoscutum not rising sharply from pronotum, more or less weakly convex; with notaulices short, sometimes not reaching anterior margin; somewhat coarsely punctate discally, more finely so laterally and anteriorly. Scutellum moderately convex; margined to about middle; finely punctate discally and very finely so peripherally. Mesopleura shining, somewhat finely punctate above, rather coarsely but not closely so below: sternaulices broad, moderately impressed: mesosternum finely and closely punctate, prepectus rather coarsely so: mesolcus strong and deeply impressed, partly closed behind: epicnemial carina very slightly elevated, extending about half-way up mesopleuron. Propodeum rather short; sharply raised from behind, and often also from in front, to base of area superomedia; with costae and especially costulae rather strong: rugulose-punctate above, mainly more shining on area superomedia and behind, but somewhat rugose before petiole; with area pleuralis mainly finely punctate: area superomedia hexagonal, not greatly longer than broad: area posteromedia extending to beyond middle.

Petiolar segment not notably elongate, normally 1·6 to 2·0 times length of its greatest breadth; obscurely rugose-punctate to near apex; laterally distinctly margined, with spiracular tubercles very prominent; with dorsal keels strong, though not nearly attaining apex, distinctly canaliculate between them. Tergite 2 with thyridia somewhat indistinct, especially in paler specimens. Remainder of gaster more and more finely punctate towards apex. Female third valvulae very broad, with ventral margin slightly sinuate and, on the whole, slightly upcurved; projecting well beyond apex of tergite 8 (Fig. 21).

Fore wings with basal and disco-cubital veins parallel or slightly convergent; with radius slightly upcurved at apex and often slightly sinuate; with areolet shortly petiolate; with second recurrent strongly sinuate; with nervus parallelus emitted about in middle of brachial cell. Hind wings with nervellus slightly antefurcal, intercepted in or slightly below middle.

Claws of all tarsi strongly pectinate.

Length 8 to 10 mm.

Head bluish-black, with the following parts deep flavous, margined with fulvous: mouth-parts except mandibular apices, clypeus, genae except near occiput, lower face except for an incomplete median darker line, margins a little way up and a median mark on upper face. Antennae deep flavous to pale ferrugineous, darker above except for annellus and base of postannellus. Thorax and propodeum bluish-black, with the following parts deep flavous margined with fulvous: wide anterior marginal mark and humeral angles of pronotum, propleura in part (though often not at all flavous in male), and conspicuous marks of scutellum and metascutellum: often there are pale marks beneath the wings, and ferrugineous hind margins of scutellum, metascutellum and mesopleura: tegulae flavous. Fore and mid legs mainly more or less fulvous; on fore and sometimes mid legs the coxae, except at base, and the trochanters and trochanterelli, are decidedly paler; mid coxae darker at base: hind legs rufous; with coxae mainly, and trochanters, trochanterelli and femora above, pale ferrugineous to almost black. Wings with veins and stigma ferrugineous, much paler at base. Gaster black, typically with the following parts rufous: tergites 1 at extreme apex, 2 and 3 and most of 4, pygopods and most of sternal region: but the rufous coloration is occasionally less and sometimes more extensive.

Redescribed from the following material: ENGLAND, Cambs., Wicken Fen, 1 ♂, 31. vii. 1925, H. T. Pagden, 1 ♀, 26.viii. 1931, 1 ♀, 26.vii. 1933, G. J. K.; Norfolk, Catfield, 2 ♀♀, 12–16.vii.1920, J. J. F. X. King: BELGIUM, unlocalized, 6 ♂♂, 4 ♀♀, Diest, 2 ♂♂, 2 ♀♀, viii.1849, C. Wesmael: GERMANY, Silesia, Breslau, 1 ♀, 8.vii.1937, 1 ♂, 19.vii.1938, K. Hedwig; Ruthe coll., 1 ♂, 1 ♀, Buchecker coll., 1 ♂, 13.vii; unlocalized (probably Germany), 2 ♂♂, O. Schmiedeknecht: CZECHOSLOVAKIA, Bohumin, Haatsch, 1 ♀, 24.vii.1938, Th. Kupka: SWEDEN, Skåne, Pålsjö, 1 ♀ (lectotype), Örtofta, 1 ♂ (allotype), C. G. Thomson.

Additional material seen: FRANCE, Arras, Chaville (near Paris), 6 specimens, 23.vi–ix, J. de Gaulle: GERMANY, Schladen, 1 ♂, 20.viii.1945, R. Hinz; Bavaria, Haag-an-der-Amper, 1 ♀, 15.viii.1947, 1 ♂, v. 1948, G. Heinrich: RUSSIA, Perm, 1 ♀, 25.vii.1926, Lubischew (coll. A. Seyrig).

Time of appearance. On the data available I do not think that Heinrich (1949*b*: 121) was justified in postulating two generations, for I have June and a number of July dates for this species. It is, however, possible that there are two generations that nearly or quite overlap.

The elongate form of the antennal scape is very characteristic, and enables this species to be separated at once from species of *Cteniscus* of similar appearance, even when the mandibles cannot be seen.

Anisoctenion laetus Gravenhorst

1829 *Mesoleptus laetus* Gravenhorst, *Ichneumonologia Europaea*, **2**: 50–51.
1906 *Acrotomus laetus* Pfankuch, *Z. Hym. Dipt.* **6**: 23.

Three forms have been separated in the key to species, and further distinguished below. These are here treated as varieties of a single species *laetus* Grav.; though Thomson (1883) treated all three as separate species.

The species as a whole was described by Gravenhorst (1829) as *Mesoleptus laetus*. Pfankuch (1906) refers to a label of Förster's as *Delotomus*, and states that the description of *Acrotomus orbitatorius* Schiødte by Holmgren corresponds with the type.

The form that is here regarded as typical and described in full agrees fairly well with the description of *Tryphon cephalotes* Gravenhorst. It was thus identified by Thomson (1883: 885): the present redescription is partly based on a pair of specimens from Thomson's series, and also a female thus named in the Ruthe collection.

Pfankuch (p. 296), in placing *cephalotes* in synonymy with *laetus*, stated that the type was missing from the collection. He gave the sex as female, which it must have been, according to the genal coloration, if it really was the *Anisoctenion* species.

The first reviser of *cephalotes*, however, was Stephens (1835, **7:** 250–251), who had not an *Anisoctenion* but a species of *Ctenicus* (also mixed with *cephalotes* in the Ruthe collection). A single female specimen bears Stephens's original label: this was placed in the British Museum collection, perhaps by C. Morley, under *Ctenicus pictus* Grav., together with several other Stephens specimens which that author, who made no mention of *pictus*, may have placed as *cephalotes* (see Morley, 1911: 194).

I have worked through Gravenhorst's original description to see which of the two interpretations, that of Stephens or that of Thomson, can be better substantiated; but the result has been inconclusive. It seems preferable to disturb the present nomenclatorial usage as little as possible, pending a solution of the problems here considered; so the form of the species now described in full will be referred to as var. *cephalotes* Grav. Thoms.

Thomson did not recognize *laetus* Grav. The other two forms he described as new species, *marginatus* and *calcaratus*. Gravenhorst's description of *laetus* was evidently made from a series of males; and it represented the variation within the species as he saw it. The name *laetus* cannot, therefore, be used in a restricted sense for any one of the three varieties until the Gravenhorst series has been re-examined and a lectotype recognized.

A full redescription has been made of the form *marginatus* Thoms., in order to compare it most carefully with *cephalotes* Grav. Thoms. One of the specimens thus studied was a female from Thomson's series, which was both previously and subsequently compared with the type pair from Isgärde on Öland. Schmiedeknecht added nothing to our knowledge of *marginatus*. Roman, in arranging the Swedish collection in the Stockholm museum, followed Thomson's nomenclature, but made *marginatus* a variety of *cephalotes*.

The male type of *calcaratus* has remained unique and unstudied since being described by Thomson (1883: 885).

Variety *cephalotes* Gravenhorst, Thomson

1829 ? *Tryphon cephaoltes* Gravenhorst, *Ichneumonologia Europaea*, **2**: 246–247.
1883 *Delotomus cephalotes* Thomson, *Opuscula Entomologica*, fasc. 9: 885 (*non Tryphon cephalotes* Stephens, 1835).
1906 *Acrotomus laetus* = *cephalotus* Pfankuch, *Z. Hym. Dipt.* **6**: 296.

Head (Fig. 22) distinctly, generally strongly, broadened behind eyes; moderately emarginate behind: more or less finely and closely punctate, more closely so on medial parts of lower and upper face and on genae. Clypeus (Fig. 23) not strongly transverse; with moderate punctures, which are separated by about their own diameters above, but are a little coarser and considerably sparser below; sharply delimited basally; with apical margin not broadly rounded, but in middle almost truncate or slightly emarginate (not, however, with distinct apical angles as in *Acrotomus s. str.*); very weakly convex, weakly transversely impressed before apical margin. Malar space nearly half basal width of mandible, and a little shorter than distance between mandibular apices. Hypostomal costa rather strongly, but very obtusely and roundedly raised: genal costa distinctly raised, inflected.

Antennae with scape of normal proportions, moderately excised externo-ventrally:

flagellum 28- to 32-segmented, almost filiform, tapering slightly to apex; with post-annellus rather strongly curved externally.

Pronotum with dorsal transverse impression broad and shining; with epomiae strong; behind epomiae shining and moderately punctate above, strongly longitudinally rugose below (seldom very incompletely so). Propleura shining and rather finely punctate; rugose anteriorly and by inner margin. Mesoscutum strongly convex to middle, though not very sharply raised anteriorly; more or less finely and closely punctate; with notaulices short, distinct near but not reaching anterior margin. Scutellum of rather flattened appearance; with margins distinct to far beyond middle and almost appearing to extend round apex; very finely punctate, very sparsely so on disk, more densely near periphery. Mesopleura rather evenly and strongly punctate, mesosternum rather finely so: sternaulices broad but shallow: mesolcus not deep, narrow in anterior half then greatly broadening, partially closed by a deeply incised ridge behind: epicnemial carina distinctly elevated, dorsally incomplete. Propodeum above finely and somewhat densely punctate like the mesoscutum, on area pleuralis more strongly and densely so, elsewhere finely rugose; with costae including costulae of moderate strength: area basalis excavate, generally not fully delimited: area superomedia distinctly longer than broad: area petiolaris not extending to middle.

Gaster nearer spindle-shaped than clavate, but much more strongly narrowed to apex than to base: petiolar segment rather strongly and densely punctate except at apex; remainder of gaster much more finely so. Petiolar segment of female 1·7 to 2·3 times, of male 2·0 to 2·4 times as long as broad: laterally rather sharply margined, with spiracular tubercles not very prominent; with dorsal keels distinct to well beyond middle but not very strong; outside the keels rather strongly and densely punctate, but between them more sparsely and irregularly punctate to rugose-punctate, smooth behind. Tergite 2 with thyridia often well defined but seldom conspicuous, not broad. Female third valvulae projecting very little beyond apex of tergite 8; not broad, with ventral margin slightly sinuate or almost straight.

Fore wings with basal and disco-cubital veins slightly convergent; with second abscissa of radius very slightly sinuate or almost straight; with areolet more or less shortly petiolate; with nervus parallelus emitted about in middle of brachial cell. Hind wings with nervellus slightly antefurcal and intercepted below middle.

Tarsal claws strongly pectinate in female, rather strongly in male.

Length 7½ to 10 mm.

Female. Head black, with the following parts stramineous to flavous, margined with ochraceous: genae largely, clypeus and lower face mainly. The pale coloration on the genae is confluent with that on the lower face, and extends about a quarter the way up the outer orbit, and also broadly to the lower articulation of the mandible: dark coloration extends along clypeo-frontal suture, and on lower face to a variable extent down mid line and from outer parts of antennal sockets, and up from the clypeo-frontal suture towards these marks. Mandibles stramineous to flavous, merging through ochraceous to the black tips. Antennae fulvo-testaceous, darker above and towards base; the scape and pedicellus generally black above. Thorax and propodeum black, with margins of some sclerites, and often with apical marks of scutellum and metascutellum castaneous; with tegulae more or less pale rufous; with humeral angle and usually with lower margin of pronotum pale. Fore and mid legs rather pale rufous, becoming paler towards apex: hind legs darker rufous, merging to castaneous or almost black at base: fore coxae and trochanters largely flavous below; all trochanters paler at apex. Wings with veins and stigma ferrugineous, basally dull flavous. Petiolar segment black, rufous usually only at extreme apex. Remainder of gaster rufous, tending to paler below, somewhat infuscate near base.

Male. Head black, sometimes with a pair of pale marks on epistoma; with pale marks of inner orbits extending from about level of antennae, usually beyond lowest level of eye but never quite to mandibular base. Clypeus black at base and sides, with rufous or paler colour by apical margin, or more extensive. Lower margin of pronotum often not pale. Coloration otherwise as in female.

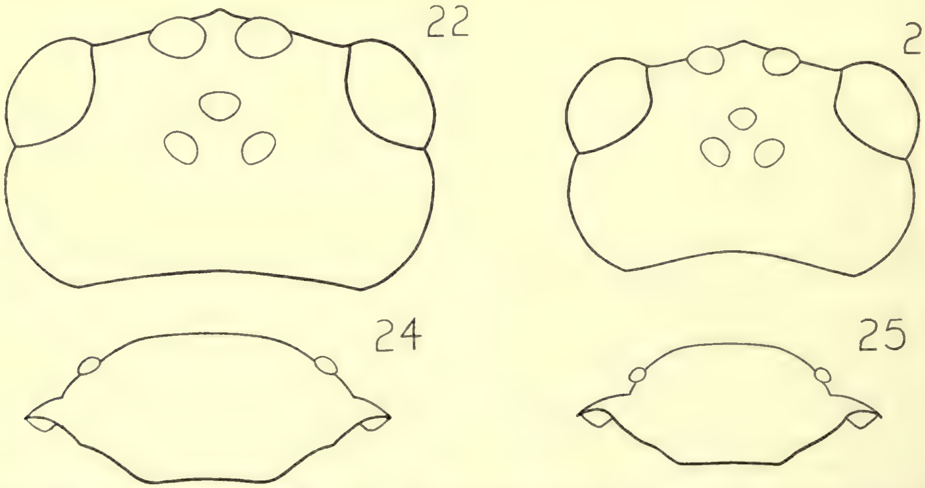
Redescribed from the following material: SWEDEN, mus. Stockholm, 5 ♀♀, 3 ♂♂, provinces of Småland, Östergötland, Bohuslän, Stockholm, Gästrikland, and Dalarne, det. Holmgren as *orbitatorius* Schiødte and det. Roman as *cephalotes* Grav.: GERMANY, 1 ♀, Ruthe coll.: SWITZERLAND, Engadine National Park, Val Munster, 2 ♂♂, 2 ♀♀, 3.vii.1922, Ch. Ferrière; Peney 1 ♂, 18.v.1878, Tournier.

Variety *marginatus* Thomson

1883 *Delotomus marginatus* Thomson, *Opuscula Entomologica*, fasc. 9: 885.

Differs from the form *cephalotes* Grav. Thoms. as follows: head (Fig. 24) rather shallowly emarginate behind; for the most part moderately punctate. Clypeus rather finely punctate; at apex rather broadly almost truncate (Fig. 25), the truncation broader than in *cephalotes*. Antennal flagellum 27- to 31-segmented.

Pronotum irregularly rugose-punctate below. Propodeum with hinder lateral costae of the area superomedia usually weak or absent.



FIGS. 22–25. *Anisoctenion laetus* Grav. Head in dorsal view of Fig. 22. var. *cephalotes* Grav. Thoms. Fig. 23. var. *marginatus* Thoms. Clypeus of Fig. 24. var. *cephalotes* Grav. Thoms. Fig. 25. var. *marginatus* Thoms.

Petiolar segment on the average a little more elongate than that of *cephalotes*: laterally usually not sharply margined; with dorsal keels usually distinct to well beyond middle, but so weak as scarcely to interrupt the general convexity of the segment.

Tarsal claws rather weakly pectinate in female, weakly so in male.

Length 6 to 8 mm.

Female with flavous coloration not predominating on lower face, extending only a little way on to the genae and scarcely at all up outer orbits: male with pale margins of the inner orbits often short.

Redescribed from the following material: SWEDEN, mus. Lund, 1 ♀, Gotland, placed as *marginatus* Thoms.; mus. Stockholm, 1 ♂, 1 ♀, Gotland, det. A. Roman as *cephalotes* var. *marginatus* Thoms.: HOLLAND, Venlo, 1 ♂, 28.vi.1942, H. G. M. Teunissen, det. A. Roman as *marginatus* Thoms.: SWITZERLAND, Geneva, Peney, 1 ♂, 20.v.1889, Tournier: SPAIN, 4 ♂♂, province Madrid, province Avila, Sierra Morena, J. Abajo and A. Seyrig: ENGLAND, Cornwall, Botusfleming, 2 ♂♂, Marshall coll.; Devon, Ideford, 1 ♂, J. F. Perkins: IRELAND, Co. Sligo, Toberscanavan, 1 ♀, 22.vii. 1933. Co. Clare, Clooncoose, 1 ♂, 22.vii.1924, A. W. Stelfox.

Variety *calcaratus* Thomson

1883 *Delotomus calcaratus* Thomson, *Opuscula Entomologica*, fasc. 9: 885.

The unique male type agrees with the description of *cephalotes* Grav. Thoms. in almost all respects; but it is a large dark form with the sculpture more than ordinarily pronounced. The length is 10 mm., and the petiolar segment is just over twice as long as broad. The tarsal claws may be described as strongly pectinate. The notaulices do reach the anterior margin of the mesoscutum. As indicated by Thomson, the area superomedia is not much longer than broad. The hind tibiae each bear a minute spur; but the right-hand spur is more than double the length of the left-hand one.

This specimen may be only a freak form of *cephalotes* Grav. Thoms.

Further material examined: of var. *cephalotes* Grav. Thoms.: BELGIUM, Rouge Cloitre, 1 ♀, 1849, C. Wesmael: GERMANY, Bavaria, Haag-an-der-Amper, 1 ♂, v. 1948, G. Heinrich (recorded as ? *rubiginosus* Grav., Heinrich, 1949*b*: 122). Of var. *marginatus* Thoms.: IRELAND, Co. Dublin, Slade of Saggart, 1 ♀, 22.vii.1936, A. W. Stelfox: ENGLAND, Surrey, Byfleet, 1 ♀, 26–29.v.1949, R. B. Benson: FRANCE, Maisons Laffitte, &c., 5 specimens, J. de Gaulle; Alpes-Maritimes, Peira-Cava, 1,500–2,000 m., 55 specimens, 1931, A. Seyrig. Of intermediate form: BELGIUM, unlocalized, 2 ♂♂, C. Wesmael: RUSSIA, Orel, 1 ♂, 25.vi.1943, R. Hinz.

The varieties *cephalotes* and *marginatus* have been kept separate at the present stage because it has proved possible to place most specimens into one or the other with confidence; but intermediate forms have now been found, as above recorded. When really adequate material is available from the whole European range of this generally scarce species, it seems likely that the varietal status will prove untenable.

Anisoctenion alacer Gravenhorst

1829 *Tryphon alacer* Gravenhorst, *Ichneumonologia Europaea*, **2**: 132.
1858 *Acrotomus xanthopus* Holmgren, *Svensk Vet.-Akad. Handl.* **1**: 223.
1906 *Acrotomus alacer* Pfankuch, *Z. Hym. Dipt.* **6**: 86.
1907 *Anisoctenion xanthopus* Schmiedeknecht, *Die Hymenopteren Mitteleuropas*, 618.
1911 *Anisoctenion alacer* Schmiedeknecht, *Opuscula Ichneumonologica*, **5**: 2295.

Head (Fig. 19) sub-cubical, having a length behind the eyes, as seen from above, much greater than the eye length in same view; scarcely broader than thorax; moderately narrowed and very little rounded behind eyes; very broadly and shallowly emarginate behind, the margin often perceptibly sinuate: with vertex and temples rather finely punctate; with cheeks moderately and upper face also more densely punctate; with lower face moderately, or near middle more coarsely punctate; malar space more or less coriaceous. Cheeks long; convex below in front view. Clypeus (Fig. 9) elongate-pilose; sparsely and for the most part rather coarsely punctate in upper half, virtually impunctate in lower half except for a row of piliferous punctures just before the margin; basally not deeply delimited; with apical margin varying from very broadly rounded, as in the specimen figured, to rather narrowly so; in side view rather strongly or strongly convex, and not always impressed before apical margin. Malar space about equal to distance between mandibular apices, sometimes rather less. Hypostomal costa weakly raised: genal costa scarcely raised, meeting hypostomal costa far behind mandibular base.

Antennae elongate and slender; with scape strongly excised externo-ventrally; with flagellum 34- to 41-segmented.

Pronotum abnormally forwardly produced, narrowly rounded in front, and distinctly punctate on the fore part; with dorsal transverse furrow shallow, but broad and more or less longitudinally costate in middle; with epomiae rather strong in middle but indeterminate below; laterally moderately punctate above, rather strongly longitudinally rugose behind and below, more finely sculptured in male. Propleura rather coarsely punctate; anteriorly coarsely reticulate-rugose; laterally very sharply margined. Mesoscutum rather strongly and evenly convex; with notaulices short, but strongly impressed and transcostate; finely to moderately and rather closely punctate. Scutellum weakly to strongly convex; not margined to middle; finely to moderately punctate, usually impunctate and shining in centre. Mesopleura coarsely punctate below, moderately so above: sternaulices broad and very superficial: mesosternum moderately and closely punctate, prepectus rather coarsely so: mesolcus indicated by a transcostate line or ridge; scarcely impressed anteriorly, broadening and merging into a wider concavity posteriorly; sometimes appearing to be closed by a strong transcosta, but continuing between cavities of mid coxae: epicnemial carina scarcely elevated, extending well up mesopleura. Propodeum elongate, rather strongly griseo-pilose; obscurely rugose discally, more or less shining near periphery; finely punctate on area externa and moderately so on area pleuralis; with costae rather weak and indefinite above, strong behind: area basalis somewhat excavate, but not sharply defined: area superomedia two to three times as long as broad, weakly arcuately trans-rugose: area posteromedia broader than long, shining, sometimes divided by a distinct median keel.

Petiolar segment 1·5 to 1·8 times length of its greatest breadth in female, 1·9 to 2·2 times in male; almost evenly explanate from near base to apex, weakly so in male, rather strongly so in female; laterally distinctly margined, with spiracular tubercles more or less prominent; with dorsal keels rising very sharply at base, margining a strongly raised medial area, approaching closely before or between spiracles, but becoming indistinct not far behind middle of segment; rather finely punctate, or in part finely rugose, beside the keels, finely punctate between and behind them. Tergite 2 with thyridia conspicuous, in male large: thyridia of tergite 3 distinct. Remainder of gaster very finely punctate. Female hypopygium large. Female third valvulae rather broad but not large; not or scarcely reaching apex of tergite 8; with ventral margin scarcely curved.

Fore wings with basal and disco-cubital veins decidedly divergent; with areolet sessile or very shortly petiolate; with nervus parallelus emitted below middle of brachial cell. Hind wings with nervellus rather strongly antefurcal, intercepted far below middle.

Legs elongate and slender. Claws of all tarsi rather strongly to strongly pectinate.

Length of female 8 to 10, of male 8½ to 11 mm.

Head black, with the following parts stramineous to flavous, margined by fulvous (the colour often appearing to have been dulled by cyanide vapour): clypeus, except for a broad basal margin, and mandibles except at apex. Palpi more or less rufo-testaceous. Antennae ferrugineous or darker, darker above; usually with a series of basal segments at apical margin, and annellus mainly, distinctly paler. Thorax and propodeum black; with humeral angles of pronotum, tegulae, and metategulae stramineous to flavous, the pronotal marks usually margined with fulvous. Legs mainly rufous to rufo-testaceous; with fore and mid tarsi at apex, hind tarsi largely, and hind tibiae sometimes at apex, darker; with coxae often darker in part; with fore coxae and fore and mid trochanters in front often flavous. Wings with veins ferrugineous to testaceous, much paler at base; with stigma pale testaceous. Gaster black; with thyridia castaneous; with tergites 2 to 7 usually finely pale-margined: in male to some extent pale beneath, especially on fore part; in female with hypopygium and region behind it rufous to ferrugineous, and with preceding sterna stramineous to ochreous or citreous.

Redescribed from the following material: ENGLAND, Stephens coll., 1 ♂, 2 ♀♀; Devon, Newton Abbot, 3 ♂♂, 1 ♀, R. C. L. Perkins and J. F. Perkins; Lancs., Manchester, Mersey banks, 1 ♀, L. Nathan, 6 ♂♂, 2 ♀♀, G. J. K.: BELGIUM, Sysseele, Groenendael, Stockal, Cortenaeken, Charleroy, 12 ♂♂, 2 ♀♀, Wesmael and Tosquinet coll.: GERMANY, ? Bavaria, 3 ♂♂, 2 ♀♀, Buchecker coll.; Silesia, Mühlbach, 1 ♂, K. Hedwig.

Further material seen: ENGLAND and GERMANY, 25 specimens in British Museum collection: SWEDEN, material in Holmgren collection: FRANCE, Haute Marne, Clerc; Rambouillet, J. de Gaulle (altogether 4 specimens): AUSTRIA, holotype. Recorded from Holland (Teunissen, 1948) and Czechoslovakia (Gregor, 1929). The Woldstedt specimen recorded from Finland is a female *Cteniscus similis* Hlgr.

All the dates, where recorded, are in the months of September and October, usually in the first three weeks of October.

The Silesian male, kindly given me by Rektor K. Hedwig in 1936, was compared with the type in the Gravenhorst collection. The synonymy of *xanthopus* Hlgr. was confirmed in Stockholm in 1937.

Morley (1911) quoted the description of *Tryphon anceps* Stephens (1835), which he considered to be 'almost indubitably synonymous'. Stephens's specimen is not to be found in the British Museum collection; but from the description and date of capture, I consider such synonymy to be not at all probable.

This is a rather isolated species within the genus. The elongate, greyish-black body caused some earlier workers to confuse it with *Dyspetes praerogator* Grav., which it superficially resembles. Peculiar features are the forwardly produced pronotum, the ill-defined, transcostate mesolcus, and the elongate legs, including particularly slender hind femora (Fig. 16). Notable also are the transcostate notaulices, the elongate areola, and the sharply raised medial area of the petiolar segment. The subcubical head and colour pattern of the clypeus it has in common with an apparently new species, of which two males are available, and which is here briefly diagnosed but not validated. But that species does not share with it any of the other features mentioned in the present paragraph.

Biology. Herr Rolf Hinz has taken this species in the Hannover district in October, flying between grass in the woods. He finds that it parasitizes species of *Tenthredopsis*. The egg is laid externally not far behind the head of the host larva. This makes no defensive movements, and the parasite may ride it for a considerable time.

Clausen (1932) studied the life-history of a species determined as *A. alacer* Grav. It was parasitizing a species of '*Allantus*' on oak at Suigen in Korea. R. B. Benson tells me this would probably be *Allantus* (= *Emphytus* auctt.) *togatus* Panz. or some related species.

Anisoctenion genalis Thomson

This species may be diagnosed by the sum of the characters leading to it in the key to species (pp. 350–354).

Diagnosed from the following material: ENGLAND, Devon, Dartmoor, 1 ♂, 8.vi.1935, R. C. L. Perkins: AUSTRIA, Styria, Bösenstein Massif, 1,800 m., 1 ♂, 8.vi.1950, G. Heinrich: see also supplement (p. 454 below).

This species forms a connecting link with the genus *Cteniscus*. When further material was seen in 1952, including both sexes, I was able to determine it. A description is given in the supplement (p. 452 below).

KEY TO PALAEARCTIC SPECIES OF *ANISOCTENION* FÖRSTER

1. Female third valvulae more or less distinctly decurved (Fig. 15): mesopleura more or less coarsely and closely punctate and either epicnemial carina strongly raised or malar space very short: hypostomal costa raised into a rather sharp tooth in known European species 2

Female third valvulae not thus distinctly decurved: neither epicnemial carina strongly raised nor female malar space very short: if the male malar space is very short the mesopleura are rather finely and sparsely punctate: hypostomal costa, if rather strongly, then very obtusely and roundedly raised . 4

2. Clypeus very strongly transverse, not coarsely punctate nor deeply or sharply delimited: malar space not very short: flagellum 24- to 30-segmented: epicnemial carina strongly raised between sternaulices: hypostomal costa raised into a rather sharp tooth where met by genal costa: larger specimens are rather stoutly built . . . . *rubiginosus* Grav.

   Clypeus less transverse, coarsely punctate or at least with some coarse punctures, and deeply or at least sharply delimited: malar space very short in both sexes: flagellum 32- to 36-segmented: epicnemial carina very slightly raised: species of rather slender build 3

3. Hypostomal costa raised into a rather sharp tooth where met by genal costa (as in *rubiginosus* Grav.): female hypopygium not sharply folded mid-ventrally: claws of all tarsi very strongly pectinate: antennal scape shorter (Fig. 27): Europe. . . . . *triangulatorius* Grav.

   Hypostomal costa weakly raised, not at all 'dentate': female hypopygium sharply folded mid-ventrally: tarsal claws no more than moderately pectinate: antennal scape longer (Fig. 26): Japan, unknown in Europe *yakui* Uchida

4. Head not broadened or sub-cubical, not longer behind eyes than eye length, seen from above: either mesopleura rather finely and sparsely punctate or tergite 2 and female hypopygium as in second half of couplet 5 5

   Head broadened or sub-cubical, distinctly longer behind eyes than eye length, seen from above: mesopleura strongly punctate in lower half: tergite 2 and female hypopygium not so 10

5. Mesopleura finely or rather finely punctate: sternaulices strongly impressed: tergite 2 and female hypopygium not as in alternate 6

   Mesopleura moderately or strongly punctate below: sternaulices no more than moderately impressed: tergite 2 with a pair of diagonal furrows extending outward from base: female hypopygium sharply folded mid-ventrally . 9

6. Head strongly narrowed behind eyes (Fig. 18): tarsal claws with pectination absent or weak: female third valvulae not as in alternate . . . 7

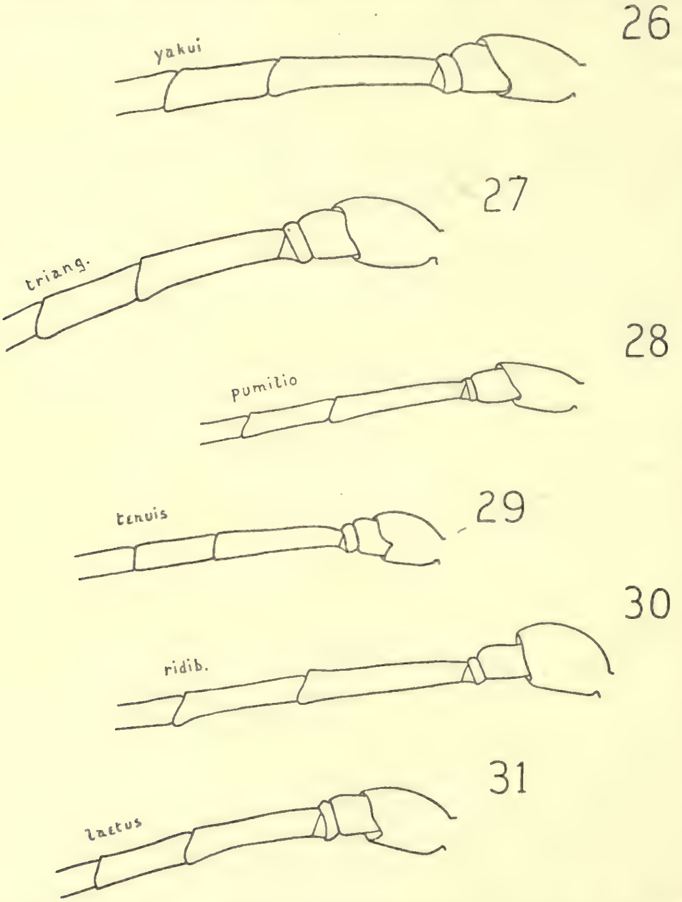
   Head no more than moderately narrowed behind eyes: tarsal claws moderately and very distinctly pectinate: female third valvulae moderately broad in side view and very broad as seen from above, almost 'vomeriform', shortly and densely hairy below: NE. Burma, Formosa . . . . . sp.

7. Propodeum strongly raised to base of area superomedia, which is little longer than broad: petiolar segment not $1\frac{1}{4}$ times as long as broad . . . . cf. *Cteniscus rufonotatus* Hlgr.

   Propodeum not thus strongly raised, with area superomedia distinctly longer than broad: petiolar segment more than $1\frac{1}{2}$ times length of its greatest breadth 8

8. Pedicellus abnormally elongate (Fig. 28), narrower below than width of malar space: flagellum 22- to 25-segmented: scutellum not margined to middle: propodeum short, with area posteromedia roughly quadrate: petiolar segment up to twice length of its greatest breadth: Europe . . *pumilio* Hlgr.

Pedicellus short and stout (Fig. 29), broader below than width of (male) malar space: flagellum 28- to 31-segmented: scutellum sharply margined to beyond middle: propodeum long and not at all sharply declived, with area posteromedia strongly transverse: petiolar segment more than three times length of its greatest breadth: female unknown: NE. Burma, Formosa . *tenuis* sp. n.



FIGS. 26–31. Antennal scape and following segments, in sinistro-lateral view, of Fig. 26. *Anisoctenion yakui* Uchida. Fig. 27. *Anisoctenion triangulatorius* Grav. Fig. 28. *Anisoctenion pumilio* Hlgr. Fig. 29. *Anisoctenion tenuis* sp.n. Fig. 30. *Anisoctenion ridibundus* Grav. Fig. 31. *Anisoctenion laetus* Grav. var. *marginatus* Thoms.

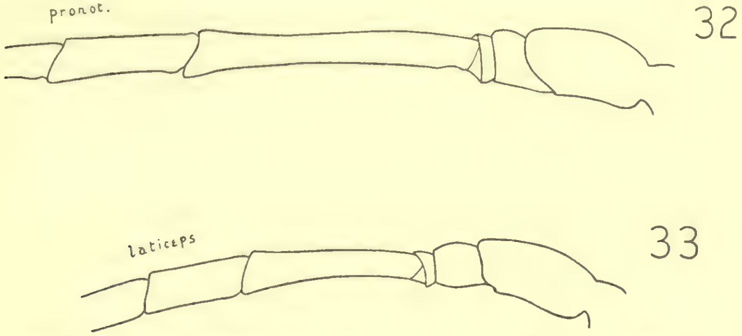
9. Pronotum and prepectus not with abnormal developments as in alternate: postannellus about one and a third times length of the following antennal segment, measured along inner margin (Fig. 30): petiolar segment not more than about twice the length of its greatest breadth; with dorsal keels distinct though short: tergite 3 almost entirely black or blackish: length 9 mm. or less: Europe . . . . *ridibundus* Grav.

Pronotum with lateral margins suddenly expanded to produce broad flanges:

prepectus with a pair of sharp keels which close the fore coxal cavities laterally: postannellus twice the length of the following antennal segment, similarly measured: petiolar segment 2·8 times length of its greatest breadth; with dorsal keels scarcely indicated: tergite 3 almost entirely red: length 10 mm. or more: NE. Burma, Formosa . . . . *pronotalis* sp. n.

10. Head more or less broadened and strongly rounded behind eyes (Figs. 22, 23): clypeus not coloured as in alternate 11

Head sub-cubical, slightly and almost rectilinearly narrowed (Fig. 19): clypeus stramineous to flavous, margined with fulvous; and with a broad, blackish band along basal margin. 14



Figs. 32–33. Antennal scape and following segments, seen from above, of Fig. 32. *Anisoctenion pronotalis* sp.n., illustrating especially the elongate postannellus. Fig. 33. *Anisoctenion laticeps* Grav., illustrating especially the elongate scape.

11. Scape very elongate (Fig. 32): clypeus as in Fig. 8: female third valvulae very broad, extending well beyond apex of tergite 8 (Fig. 21): male genae, like those of female, largely flavous . . . . . . *laticeps* Grav.

Scape not unusually elongate (Fig. 31): clypeus as in Figs. 24, 25: female third valvulae not broad, scarcely projecting beyond apex of tergite 8; pale coloration scarcely touching genae of male (*laetus* Grav. agg.) . . . 12

12. Head rather shallowly emarginate behind (Fig. 23): clypeus at apex rather broadly almost truncate (Fig. 25): malar space much shorter than distance between mandibular apices: tarsal claws more weakly pectinate in each sex respectively: female with flavous coloration not predominating on lower face, extending only a little way on to the genae and scarcely at all up the outer orbits . . . . . . *laetus* Grav. var. *marginatus* Thoms.

Head moderately emarginate behind (Fig. 22): clypeus with apical margin in middle almost truncate (Fig. 24), more narrowly so than in var. *marginatus*: malar space not much shorter than distance between mandibular apices: tarsal claws more strongly pectinate in each sex respectively: female with flavous coloration predominating on lower face, extending broadly on to the genae and about a quarter the way up the outer orbits 13

13. Area superomedia distinctly longer than broad: hind tibiae with no spur . . . . *laetus* Grav. var. *cephalotes* Grav. Thoms.

Area superomedia not much longer than broad: hind tibiae each bearing a minute spur: unique male . . . . *laetus* Grav. var. *calcaratus* Thoms.

14. Pronotum strongly produced forward: mesolcus not distinctly impressed, indicated by a transcostate line or ridge: legs, particularly hind femora (Fig. 16), elongate and slender: antennal flagellum 34- to 41-segmented: a rather large species, length 8 to 11 mm., with male of elongate and slender build, and with gaster mainly greyish-black . . . . *alacer* Grav.

Pronotum not strongly produced forward: mesolcus distinctly, though not deeply impressed: legs, particularly hind femora, not nearly so elongate and slender: antennal flagellum less than 34-segmented 15

15. Pronotum laterally above and mesoscutum rather coarsely and closely punctate; gaster shallowly, but for the most part moderately and closely punctate: gaster with tergites 2 to 4 red . . . . . . *genalis* Thoms.

Pronotum laterally above and mesoscutum finely punctate; gaster for the most part extremely finely punctate: gaster blackish or deep castaneous, with tergites finely pale-margined at apex: male unknown to me . . . . cf. *Cteniscus similis* Hlgr.

Genus *EXENTERUS* Hartig

1837 *Exenterus* Hartig, *Arch. Naturgesch.* **3** (1): 156.
Tricamptus Förster 1868, Thomson 1883 *non* Woldstedt 1874, **syn. n.**
Picroscopus Förster 1868, **syn. n.**
Picroscopus Thomson 1883 *non* Förster.
Picroscopus Davis 1897, synonym by Roman 1913.

Like the majority of Förster's genera, *Picroscopus* was founded without the citation of any species. It was adopted by Thomson for the single species *Tryphon ictericus* Grav., and has been understood thus by later authors.

Förster's diagnosis of *Picroscopus* was extracted from his key to genera and quoted by Schmiedeknecht as follows: 'Flügel mit Areola; Hintertibien ohne Sporn; Fußklauen gekämmt; Hinterleib breit sitzend, das 1. Segment gleich hinter der Basis stark erweitert und von da nach der Spitze hin fast unmerklich erweitert; Area superomedia nicht scharf umgrenzt, breiter als lang.' It has been overlooked that *ictericus* Grav. has non-pectinate claws: it disagrees, therefore, with the original generic description and, according to the interpretation of the rules generally accepted in Europe, it cannot serve as type.

Picroscopus Davis 1897 has already been synonymized with *Exenterus* by Roman (1913). Davis included two species, *Exenterus canadensis* Provancher 1883 and *Exenterus hullensis* Provancher 1886. In his key to genera (p. 227) Davis placed *Picroscopus* in a section with tarsal claws pectinate; but Cushman (1940), in his review of *Exenterus*, placed *hullensis* Prov. in a section with tarsal claws not pectinate in female. If the claws are simple in the male also, *hullensis* Prov., like *ictericus* Grav., could not serve as type.

Cushman accorded *canadensis* Prov. fuller treatment, but the identity of that species has been in doubt. In case any attempt should be made to upset Cushman's opinion, I propose to clinch the matter by proposing an alternative type.

Schmiedeknecht continues: 'Aus Försters hinterlassenen Schriften habe ich nun ersehen, daß er als Typus dieser neuen Gattung den Exenterus oriolus betrachtet hat; darauf würde wohl Niemand kommen, denn bei allen Exemplaren dieser Art, die ich untersucht habe, ist der Metathorax deutlich gefeldert, speciell die Area superomedia *gut* umgrenzt [italics mine], weit besser würden sich E. cingulatorius und ictericus als Typen für die Gattung eignen. Abgesehen von der Felderung des Metathorax paßt E. oriolus ganz gut auf die Diagnose.'

Now the nature of the bordering of the area superomedia is not easily amenable to exact definition, for it is not comparable to that occurring in, for example, *Coelichneumon*, but consists of rugosities of inconstant shape. Having before me three specimens of *oriolus*, I found that in one specimen the rugosities that border the area superomedia are raised distinctly above the others, in another they are not. While one may agree with Schmiedeknecht that the area superomedia is well bordered, I do not think it can be asserted that it is always sharply bordered. Since the evidence is that for *Picroscopus* Förster meant *oriolus* Hart. I think we should give that author the benefit of the doubt. Accordingly, as a precautionary measure, I select *Exenterus oriolus* Hartig 1838 as type of the genus *Picroscopus*, which falls into synonymy with *Exenterus*.

I intend to treat *ictericus* Grav. as a species of *Exenterus*. Apart from the coloration, it is said to differ from other known European species in having the petiolar segment angularly projecting at the base and not auriculate, and in the absence of a costula. A noteworthy character is that tergite 2 bears coarse but well-separated punctures, and is not or scarcely at all rugose. However, in *hullensis* Prov. and in smaller specimens of *adsperus* Hartig and other species, tergite 2 bears well-separated punctures over a large part of the area, and is rugose only at base and in middle. Cushman (1940) separated off a group of four North American species, including *canadensis* Prov., in which the basal carina is absent. In the shape of the petiolar segment I recognize no generic separation which appears, therefore, to break down. I am much indebted to Dr. H. K. Townes for sending me specimens of *canadensis* Prov. and *hullensis* Prov. and thus enabling me to check the points at issue. This new synonymy has been published by Mason (1951, April: 229)

The position of '*Tricamptus*' *apiarius* Grav. has been considered in the discussion of genera (p. 316).

The genus *Exenterus* has recently been revised by Cushman (1940). His paper is, of course, a very notable advance on the work of Schmiedeknecht, who began his key to species with a consideration of the coloration of the fore-legs; but even Cushman has not made adequate use of the characters afforded by the anterior part of the mesosternum. Moreover, an examination of the main European museum collections has yielded further results previously unpublished. The key to species that follows is based on Cushman's work, but incorporates such additions and modifications as I have found desirable. The determination of single males, however, remains often a matter of considerable difficulty or uncertainty.

Exenterus apiarius Gravenhorst

Most of the salient characters have been mentioned by other authors, but the following should be added: epicnemial carina distinctly, rather weakly or moderately raised: antennal scape elongate, deeply excised ventrally, its dorsal about, usually just over, twice its ventral length. The hypostomal costa is strongly raised and falls gradually to occipital foramen; and the double genal costa is similar to that of *Exyston genalis* Thoms. (Fig. 51). In well-developed specimens the scutellum has, in about apical half, a saucer-like depression, with a distinct margin in front and at sides.

Recorded in each month from May to September; the earliest day of a specimen seen by me being 17.v.1854 (male, Ruthe coll.), and the latest 10.ix (Rebais, nr. Fontainebleau, de Gaulle).

Specimens seen from Wales, England, Holland, Belgium, France, Germany, Sweden, Poland (Przepałkowo, viii.1925, G. Heinrich, mus. Paris), Russia (Perm, ♀, Lubischew, mus. Paris).

Exenterus abruptorius Thunberg

The hind margin of the cavities of the fore coxae is raised, but not bidentate: therefrom radiate strong keels to the epicnemial carina, weaker in male. Tergite 2 of gaster is generally slightly less than twice as broad as long. Antennal scape rather weakly excised externo-ventrally. For other characters, see comparison under *oriolus* Hart., and also key to species. See also Pl. 4.

Biology. This has been studied by Clausen (1932, under *coreensis* Uchida) and by Morris (1937). The species has been reared from *Diprion pini* L. and *Neodiprion sertifer* Geoffr.

The dates of emergence of reared specimens are obviously affected by laboratory conditions: in the field the adults are known to appear in the last ten days of June and in early July.

Specimens seen from England (see Kerrich, 1935), Germany (mus. Munich), Sweden (Holmgren and Thomson collections; Morris, Cameron, & Jepson), Finland (V. Saarinen; G. J. K.), France (Braunschweig and Alpes Maritimes, mus. Paris), Spain (Valencia, Cañada, Giner Mari).

Reliably recorded also from Czechoslovakia (Gregor, 1929). Doubtfully recorded from Belgium (Tosquinet, 1890). Not yet found in Holland. Introduced to Canada, but apparently failed to become established.

Exenterus simplex Thomson

Thomson (1883) made the statement 'mesosterno et unguiculis simplicibus'. Roman (1912, 1913) did not see Thomson's types, but found in Thunberg's collection specimens which appeared to agree with Thomson's description, and he regarded *simplex* as a dwarf form of *abruptorius* Thunb. Thomson's mention of locality leaves no doubt that the type is correctly identified. Examination of this type under the microscope at a favourable angle and with good illumination shows that the hind margin of the cavities of the fore coxae is, in fact, very strongly raised and strongly bidentate. The keels towards epicnemial carina are very weak and only basally developed.

Another specimen stands in the Thomson collection and has for locality only 'Suecia'. Dr. Kjell Ander informs me that the two small coloured labels indicate that it was collected by J. W. Zetterstedt in Gotland in July-August 1841.

Exenterus oriolus Hartig

1838 *Exenterus oriolus* Hartig, *Jahresber. Fortschr. Forstw.* **1:** 270.
1883 *Exenterus flavellus* Thomson, *Opuscula Entomologica*, fasc. 9: 887.

This synonymy is correct. Thomson's unique type was taken by Dahlbom on a pine needle beside a larva of *Diprion similis* Hart.; and the published locality is Kjeflinge, which is north-west of Lund.

Cushman (1940) could find no structural characters to separate this species from *abruptorius* Thunb., and wrote that it might be a colour form of it. The proportions of the head and malar space (see key to spp., pp. 364–365) and the structure of the mesosternum appear to me to render it distinct. The margin of the cavities of the fore coxae is not raised behind, but only weakly at sides, and the keels towards epicnemial carina are absent or very few. In female, the yellow colour extends about three-quarters way up eye behind it, as against about a quarter the way up in *abruptorius*. In male, the yellow bands of the first two tergites are much broader than those of following: not so in *abruptorius*.

E. oriolus appears to be a slightly shorter and stouter species than *abruptorius*: the hind legs are noticeably a little shorter and stouter relatively, and tergite 2 is slightly more than twice as broad as long in a few female specimens measured. The scape is a little more deeply excised in *oriolus* (but not sufficiently so for diagnosis); and the average number of flagellar segments is smaller, ranging from 25 to 29 as compared with 27 to 32 in *abruptorius*. The tarsal claws are less strongly pectinate.

Finally, the suggestion made to me that this is a southern colour-form of *abruptorius* is now further contra-indicated by the distributional data; for I know *abruptorius* from near the Arctic Circle down to the Spanish province of Valencia. The female specimen taken in that province is rather more extensively and brightly yellow-coloured than those from more northerly latitudes, but does not approach female *oriolus* in colour pattern.

Biology. Reared from *Diprion pini* L. and *Neodiprion sertifer* Geoffr.; and it seems likely that *D. similis* Hart. is also involved: Schmiedeknecht (1911) mentions also *Gilpinia variegata* Hart. and *frutetorum* Fabr.

Material seen from Sweden (Thomson coll.), Germany (Ruthe coll., Th. Kupka coll.), Holland (H. G. M. Teunissen coll.: Teunissen, 1948), Spain (Teruel, Orihuela del Tremedal, *ex D. pini* L.). Also recorded from France (Maneval, 1925) and Hungary (Cushman, 1940). Material obtained by Farnham House Laboratory staff, perhaps from Hungary, also seen.

Dates: Maneval's specimen was captured on 28.vii.1924; and the recorded emergences are on dates later in the year.

Exenterus ictericus Gravenhorst

1829 *Tryphon ictericus* Gravenhorst, *Ichneumonologia Europaea*, **2**: 208.
1858 *Exenterus ictericus* Holmgren, *Svensk Vet.-Akad. Handl.* **1**: 235.
1883 *Picroscopus ictericus* Thomson, *Opuscula Entomologica*, fasc. 9: 888.

The cheeks and malar space are short. The margin of cavities of fore coxae is strongly raised, and very strongly emarginate medially, as in *amictorius* Panz.: laterally it extends strongly to the fore margin behind lower angle of pronotum: ventrally there often extend from the margin to the epicnemial carina a series of weak keels producing the appearance of a row of large quadrangular punctures. The mesolcus is closed behind. The clypeus sometimes bears a pale spot: the pale anterior marks of mesoscutum are frequently missing.

Schmiedeknecht stated that the male was unknown: in fact there is very little sexual dimorphism, but in the male the dorsal keels of the petiolar segment are distinct almost to apex.

In one male specimen from the Swiss Jura the costulae are present, though weak and incomplete.

Biology. Bred from the Diprionid sawfly, *Monoctenus juniperi* L. (Forsius, 1911).

Material examined as follows: FINLAND, Kuusamo, Paanajärvi, Ruskeakallio, 1 ♀, 14.viii.1935, G. J. K. (compared with type viii.1938): SWEDEN, Jämtland, 3 ♂♂, mus. Stockholm; Holmgren coll.; Thomson coll.: BELGIUM, Béverloo, 3 ♂♂, 1 ♀, 26.vi.1867, J. Tosquinet: GERMANY?, 1 ♂, 2 ♀♀, Buchecker coll.: SWITZERLAND, Geneva, Peney, 2 ♂♂, 3 ♀♀, 10.vi–30.vii, 1885–1889, Tournier; Engadin National Park, 4 ♂♂, 24.vii–2.viii; Swiss Jura, le Crit, long series, vii.1935, A. Seyrig: FRANCE, 1 ♀, holotype; Alpes-Maritimes, long series, 1931, A. Seyrig: SPAIN, 1 ♂, viii.1904, J. Dusmet: ITALY, Piedmont, Biella, Val Chiobbia, 2 specimens, viii.1928, F. Capra: YUGOSLAVIA, Prenj Mts., 1 ♂, 15.viii.1936, V. & E. Martino.

Recorded from Germany (Thuringia: Schmiedeknecht, 1911); also from Czechoslovakia (Ruthenia, Ubušin, vi.1928: Gregor, 1929) and from Bulgaria (Rila Planina, 15–16.vii.1931: Gregor, 1933).

Dates of appearance of this species thus range from the end of June to early September.

Exenterus amictorius Panzer

This species has been generally known as *Exenterus marginatorius* Fabr. For the rejection of *Ichneumon marginatorius* Fabricius 1793 as a homonym of *Ichneumon marginatorius* Rossi 1790, and the substitution of the next available name, I follow Cushman (1943). He has reproduced Panzer's original description and figure, and I agree that these must have been intended to represent the species in question. The hind tibial spurs may have been added as an afterthought, their absence not having been noted at that time.

Hind margin of cavities of fore coxae strongly raised and bidentate: keels therefrom to epicnemial carina absent or very weak. Antennal scape very weakly excised externo-ventrally (Fig. 34). The extent of yellow coloration on the gaster is very variable. The tarsal claws are stated by Schmiedeknecht to be simple: they are, however, pectinate, at least in the female, though the pectination is weaker and less regular than in female *abruptorius*. Petiolar segment (Fig. 39).

Biology. Recorded as reared from *Diprion pini* L., *D. similis* Hart., *Neodiprion sertifer* Geoffr., *Gilpinia pallida* Klug, *virens* Klug and *polytoma* Hart. Oviposition on *D. pini* L. described by Scheidter (1934).

Dates of captured specimens range from early June to the end of September.

Material seen from England (see Kerrich, 1935), Belgium (Wesmael-Tosquinet coll.), Germany (Hartig coll., Ruthe coll.), Austria (G. Heinrich), Czechoslovakia, Poland, Sweden, Finland, Switzerland, France, Spain. Also recorded from Holland (Teunissen, 1948). Introduced to Canada, where it has become established.

Exenterus claripennis Thomson

1883 *Exenterus claripennis* Thomson, *Opuscula Entomologica*, fasc. 9: 887 (*non* Cushman, 1940).

The Thomson specimen under this name in the Lund collection is labelled 'Nerike' and is referable to *amictorius* Panz.: the type from Wittsiö in northern Skåne appears to be lost (cf. Roman, 1913). The other specimen standing under that name in the collection was taken by R. Malaise around Torneträsk, and is a later addition.

Two specimens standing under *claripennis* in the Stockholm museum were examined in 1935, and regarded as distinct from others then known to me. One bears the determination label of A. Roman who had, evidently, recognized it subsequently to the appearance of his 1913 paper, but had not, I believe, published any note to this effect. R. Malaise kindly sent me this female specimen for further study, and I now agree this species to be the true *claripennis* for the reasons which follow.

Roman wrote (1913) that he found, in Thomson's description of *claripennis*, no reliable difference from *adspersus* Hart., that Thomson had not mentioned this species with its synonym *lepidus* Hlgr., and that he thought Thomson had redescribed the 'to him unknown' *adspersus* as *claripennis*. In actual fact he redescribed *adspersus* as *laricinus*, and used the words '. . . ab *E. lepido* pictura uberiore distinctus'. So his conception of *lepidus* may have been the species now described as *confusus*.

Thomson gave for *claripennis* '*E. marginatorio* . . . valvula ventrali ♀ apice magis acuminata discedens'. Now the degree of pointedness of the female hypopygium is, when not extreme, a difficult character to use, for the appearance depends largely on the degree of folding or flattening of that organ: in *amictorius* (*marginatorius*) it seems inconstant; but the condition in the species here identified as *claripennis* might fit 'magis acuminato', whereas that in *claripennis* Cush., I think, would not, and *tricolor* has the female hypopygium beyond all comparison more pointed. Had Thomson had *tricolor*, it is unlikely that he would have omitted to mention the red coloration of the underside of the gaster. Thomson wrote 'mesosterni acetabulis haud bidentatis': in this species the acetabulae (margining the fore coxal cavities) are distinctly developed and laterally raised but not ventrally bidentate, whereas in *claripennis* Cush. and in *tricolor* they are absent or rudimentary.

Very closely related to *amictorius* Panz., from which it differs as given in key to species (p. 366).

Another authority to mistake *claripennis* was Kriechbaumer: two specimens he determined thus prove to be *vellicatus* Cush. They were bred from the same host as were Cushman's types.

E. claripennis Thoms. diagnosed from the following material: SWEDEN, Dalarne, Fulufjäll, 1 ♀, vii.1927, on snow field, K. H. Forsslund (neotype); Småland, 1 ♀, Boheman; det. A. Roman; ?Blekinge, Åryd, 1 ♂, 1 ♀, *ex Neodiprion sertifer* Geoffr., Morris, Cameron, & Jepson, det. G. J. K.

Further material seen: AUSTRIA, Styria, Bösenstein massif, 1,800 m., 1 ♂, 7.vii.1950; Ardning, 600 m., 1 ♀, 11.viii.1950, G. Heinrich: FINLAND, Kangasala, 1 ♂, R. Frey.

Exenterus adspersus Hartig

1838 *Exenterus adspersus* Hartig, *Jahresber. Fortschr. Forstw.*, **1:** 271 (*non* Morris, Cameron, & Jepson, 1937).
1858 *Exenterus lepidus* Holmgren, *Svensk Vet.-Akad. Handl.* **1:** 231 (*non* Thomson, 1888).
1888 *Exenterus laricinus* Thomson, *Opuscula Entomologica*, fasc. 12: 1254–1255.
1911 *Exenterus adspersus* Schmiedeknecht, *Opuscula Ichneumonologica*, **5:** 2307.
1913 *Exenterus adspersus* Roman, *Ent. Tidskr.* **34:** 127.
1940 *Exenterus adspersus* Cushman, *U.S. Dept. Agric. Misc. Publ.* **354:** 6–7.

Holmgren (1858) himself suggested the possibility of his species being synonymous with *adspersus* Hartig. Thomson (1888), however, redescribed *adspersus* as *laricinus* (see below), which he compared with *lepidus* Hlgr. To which species he attributed *lepidus* must remain in doubt, for none is to be found under that name in his collection. Apart from Thomson, no one questioned the synonymy until in 1935 the present author wrongly, as will be seen below, placed another species as *lepidus* (Kerrich, 1942).

Dr. E. O. Engel very kindly directed my search for the type in the Zoologische Statssammlung in Munich, but we were unable to find it. Cushman (1940) gave the first clear picture of this species, including a figure of the apex of the gaster: he also identified the species with *laricinus* Thoms., which latter name he placed in synonymy. I can support this procedure with further evidence, for I was able to borrow from Munich a specimen (dated 9.ix.1884) placed as *adspersus* by Kriechbaumer who, more than anyone, should have been familiar with Hartig's work. This specimen I found, by direct comparison in Lund, to agree with Thomson's *laricinus*. It agrees, moreover, with the characters given by Cushman (1940).

Dr. Roman, when arranging the collection of Swedish Ichneumonidae in the Stockholm museum in the years 1937–1940, selected lectotypes of the Holmgren species. The lectotype of *Exenterus lepidus* is a female specimen taken by Boheman in the Swedish province of Dalarne: by direct comparison in 1947, I find it specifically identical with the above-mentioned Munich specimen, though rather more strongly sculptured.

Further material examined: ENGLAND, Hants, New Forest, Matley Bog, 1 ♂ em. 1935, *ex* Diprionid cocoon (viii.1934), A. J. Duarte (Kerrich, 1942, as *lepidus* Hlgr.); Surrey, Dorking, Westcott, 1 ♂, 1.ix.1948, G. J. K.; Beds., Clophill and Apsley Heath, 2 ♂♂ em. iv.1948, *ex Diprion similis* Hart. (larvae ix.1947), V. H. Chambers: BELGIUM, 1 ♂, coll. Wesmael: SWEDEN, material in Holmgren coll.; Norrbotten, Boden, 1 ♀, 9.vii.1938, K. J. Hequist: FINLAND, Karislojo, material reared from *Gilpinia* *pallida* Klug by R. Forsius (Forsius, 1911: 100; Roman, 1911: 201); Karislojo, 1 ♂, 1 ♀, *ex Diprion pini* L., R. Forsius (mus. Paris): GERMANY, 5 ♀♀, coll. Ruthe; Schirmer, 1 ♀, 2 ♂♂, ix.1905, Buckow (mus. Stockholm); Saxony, Vogtland, 1 ♂, *ex* Diprionid cocoon (mus. Paris): SWITZERLAND, Nyon, 1 ♂, Cheyr: FRANCE, Toulouse, 2 ♂♂ em. iv.1925, *ex* Diprionid cocoons, Delmas.

For a note on the British specimen recorded as *lepidus* Hlgr. see below under *confusus*.

Biology. Bred from *Diprion pini* L., *D. similis* Hart., and *Gilpinia pallida* Klug (see above): recorded also from *D. nipponicum* Rohwer, *G. polytoma* Hart. and *Neodiprion sertifer* Geoffr. (Cushman, 1940).

Exenterus tricolor Roman

For characterization, see key to species and subsequent discussion of differences between the males. I find no reliable difference from *adspersus* Hart. in the amount of yellow coloration of the males, such as is suggested by Roman (1913: 127); but an average difference might be demonstrable if the two species were taken together in several different localities.

Material examined as follows: FINLAND, Finström, 1 ♂, 24–29.vii.1946, W. Hellén; Vichtis, 1 ♂, R. Frey: SWEDEN, type material of A. Roman; Skåne, Skäralid, 1 ♂, 1.vii.1938, D. M. S. & J. F. Perkins: GERMANY, 1 ♀, coll. Hiendlmayr (mus. Munich), compared with type; Köln, 1 ♀, 16.viii., 1 ♂, 23.viii.1946, W. Aerts: CZECHOSLOVAKIA, Riesengebirge and Tyssa, 5 ♀♀, Morris, Cameron, & Jepson: AUSTRIA, Styria, Admont, Kaiserau, 1,100 m., 1 ♂, 10.vi.1950, G. Heinrich.

Biology. Reared from *Gilpinia polytoma* Hart. in Finland (Forsius, 1932); and from this species and *Neodiprion sertifer* Geoffr. in Czechoslovakia and Saxony by Morris, Cameron, & Jepson (1937). These three authors give an extensive account of the life-history.

Exenterus vellicatus Cushman

For characterization, see key to species and subsequent discussion of differences between the males.

Material examined as follows: GERMANY, 1 ♀, 30.vii.1884, 1 ♀, 23.vii.1886, both *ex Gilpinia polytoma* Hart., 1 ♂, 11.viii.1888, coll. Kriechbaumer (mus. Munich); Holstein, Trittau, Hahnheide, 2 ♀♀, ix.1945, 3 ♂♂, vi.1946, G. Heinrich: CZECHOSLOVAKIA, several localities as recorded, 5 ♂♂, 11 ♀♀, *ex Gilpinia polytoma* Hart., Morris, Cameron, & Jepson (1937: 377, as *Exenterus* sp.). Recorded as established in Canada (Mason, 1951 April: 229).

Exenterus confusus sp. n.

1888 ? ? *Exenterus lepidus* Thomson, *Opuscula Entomologica*, fasc. 12: 1255 (*non* Holmgren, 1858).

1937 *Exenterus adspersus* Morris, Cameron, & Jepson, *Bull. ent. Res.* **28:** 375–376 (*non* Hartig, 1838).

1940 *Exenterus claripennis* Cushman, *U.S. Dept. Agric. Misc. Publ.* **354:** 3, 9 (*non* Thomson, 1883).

This species was taken in several specimens in northern Finland in 1935 by the present writer. It runs down in Schmiedeknecht's key to *adspersus* Hartig, and was determined thus in September 1935; with how much assistance from Dr. Roman I cannot now remember, but at least with his concurrence.

It is clearly the species identified by Cushman (1940) as *claripennis* Thoms. It has the posterior face of the propodeum generally less nearly perpendicular than in *amictorius* (*marginatorius*), as stated by Cushman; whereas in the species here identified as *claripennis* that face is rather more so. Reasons for rejecting Cushman's interpretation are given above.

As Cushman (op. cit.) supposed, this is indeed the species reported by Morris, Cameron, & Jepson as *adspersus* Hartig: I saw part of their material, and bear part responsibility for the identification. Later, after seeing the true *adspersus*, I supposed that this species must be *lepidus* Holmgren. The males, however, had still not been separated: a British specimen of *adspersus* was misidentified and recorded as *lepidus* in 1942; but in the absence of further explanation, the usual synonymy was followed by Kloet & Hincks (1945).

Diagnosis. Species with the characters given by Cushman (1940) for *claripennis* Thomson, and with those given for this species in the key below. In the female sex very distinct from *adspersus* in having the hypopygium not acute or ventrally folded, the third valvulae not reaching the apex of the gaster, and the mesosternum and pleura not largely yellow-marked.

Head moderately to strongly narrowed behind eyes, shallowly emarginate behind: on vertical region, temples and most of genae rather coarsely to coarsely and closely punctate; near malar space, and on lower face in greater part (except in smallest specimens) and upper face reticulate-punctate: upper face often with a distinct median keel. Clypeus generally distinctly alutaceous, rather finely to rather coarsely punctate above the pre-apical impression; rather strongly delimited basally; rather narrowly rounded apically. Malar space short, as usual in the genus. Hypostomal costa slightly raised; genal costa meeting it a good quarter the way back to the foramen magnum.

Antennae with scape (Fig. 38) weakly convex dorsally, weakly excised externo-ventrally; with flagellum 31- to 36-segmented.

Pronotum with dorsal transverse furrow broad and shining; with epomiae strong; laterally shallowly and rather closely punctate above, generally strongly longitudinally rugose below. Propleura rather sparsely punctate, more closely so at sides. Mesoscutum rather strongly convex (some variation in this); with notaulices just indicated; rather shallowly but more or less coarsely punctate discally, more finely punctate behind. Scutellum not margined to middle; weakly convex and moderately to coarsely punctate above; smoother and falling rather abruptly behind. Mesopleura in upper half shining, moderately punctate in front, finely so around speculum; in lower half coarsely and closely punctate: sternaulices more or less superficial: mesosternum and prepectus moderately and closely punctate: epicnemial carina scarcely elevated: mesolcus not strongly impressed; narrow in front, then broadening and sometimes transcarinate; generally well closed behind. Propodeum with costae mostly rather weak, but usually normally complete; for the most part weakly reticulate-rugose, but on area pleuralis shining and finely punctate in front; with posterior face generally less abruptly declived than in *amictorius* Panz. and *adspersus* Hart.: area superomedia strongly contracted from costulae to base and not basally delimited.

Gaster with tergites 1 and greater part of 2 rather strongly and closely reticulate-rugose, the sculpture somewhat weaker and diffuser towards apex of tergite 2; with tergite 3 in about basal half and at sides, and sometimes base of 4, closely reticulate, sometimes suggesting fine longitudinal rugosities; occasionally the reticulation is more extensive, but otherwise tergites 3 to 6 rather coarsely punctate, progressively more sparsely and shallowly so; with tergites 7 and 8 almost always finely and sparsely punctate. Petiolar segment 1·2 to 1·7, generally 1·4 to 1·5 times length of its greatest breadth; with dorsal keels of moderate strength and distinct for about three-quarters length of segment in female, rather stronger and almost percurrent in male. Apex of female gaster much as in *amictorius* Grav., but third valvulae perhaps on the average a little broader than in that species, and decidedly broader than as delineated by Cushman for that species (1940:3, fig. *c*): hypopygium not acute and not or scarcely folded in mid line: third valvulae not reaching apex of gaster.

Fore wings with basal and disco-cubital veins slightly divergent; with areolet subsessile or shortly petiolate; with nervus parallelus emitted about in middle of brachial cell. Hind wings with nervellus opposite or slightly antefurcal, intercepted about in middle.

Tarsal claws with no more than a trace of pectination at base, not evident in male.

Length 6 to 10 mm.

Head black, with the following parts deep, bright flavous: palpi, mandibles except at apex and, in male, often at base, clypeus except along suture and sometimes at apex, and lower face except for a median band. The yellow coloration extends on inner orbits at least a little way above antennal sockets; and also through malar space on to the genae, where it adjoins the mandibular base and extends a little way up outer orbits, but does not reach hypostomal costa nor approach genal costa. Antennae black, merging to ferrugineous above, dull fulvous below; with scape and sometimes pedicellus flavous-marked beneath. Thorax and propodeum black, with the following deep, bright flavous: greater part of scutellum and metascutellum; pair of roughly triangular marginal marks on mesoscutum covering notaulices, occasionally reflected on pronotum; median pair of marks on anterior margin of pronotum, often coalescing and extending towards lower angles; paired marks always below tegulae, often just above epicnemial carina, occasionally beside hind end of mesolcus, and occasionally by hind angle of area dentipara. Legs black, with the following deep, bright flavous, paler on hind leg: fore coxa extensively below and often round apex; mid coxae less extensively, sometimes only slightly below; trochanters and trochanterelli, except that those of hind leg are dark-marked; fore and, less extensively, mid femora in front and at apex; fore and mid tibiae and tarsi mainly; hind tibiae in about basal two-thirds except at extreme base; hind tarsal segments progressively more narrowly at base: hind coxae not pale marked. Wings with veins and stigma ferrugineous, basally paler. Gaster black, with the following bright flavous in female: rather broad apical bands, which often do not approach the sides, on first two tergites; and usually a series of much narrower apical bands on tergites 3 to 6: in male the narrower bands may be developed on tergites 3 to 5 only; and in darkest forms even the band on tergite 2 is undeveloped.

Described from the following material: CZECHOSLOVAKIA, Kunzak, 1 ♀ (type) from cage, 18.x.1933, 1 ♀ em. 4.xii.1933, 1 ♀ em. 29.i.1934; Hradec, 9 ♂♂, 7 ♀♀ em. vi–vii.1936; Dobris, 1 ♂, 4 ♀♀ em. vi.1936; Plese, 2 ♂♂, 1 ♀ em. vi.1936; Allrestice, 3 ♀♀ em. vi.1936; Tyssa, 2 ♂♂; unlocalized, 7 ♂♂, 3 ♀♀; Riesengebirge, 1 ♀ (undated), Morris, Cameron, & Jepson: GERMANY, unlocalized (probably Germany), 2 ♂♂, O. Schmiedeknecht (mus. Geneva); Heilbrunn, 1 ♀, 8.vi.1888, J. Kriechbaumer; Bayrische Wald, Waldmünchen, 1 ♂, 9.vi.1948, 1 ♂, 1–8.ix.1948; Holstein, Trittau, Hahnheide, 1 ♀, 29.vi.1946, G. Heinrich: SWEDEN, Lapland, Torneträsk, R. Malaise (mus. Paris): FINLAND, Kuusamo, Liikasenvaara, 3 ♂♂, 1 ♀, 9.vii.1935; Mutkatunturi, 1 ♀, 31.vii.1935, G. J. K. All the above, except the type, have been designated paratypes.

Additional material seen: AUSTRIA, Styria, Admont, Kaiserau, 2 ♂♂, 2 ♀♀, 1–8.vii. 1950, G. Heinrich. Recorded (under *claripennis* Thoms.) as established in Canada (Mason, 1951 April: 229).

Biology. The Czech material was reared by Morris, Cameron, & Jepson from *Gilpinia polytoma* Hart. with the exception of the specimen from the Riesengebirge which was from *Neodiprion sertifer* Geoffr.: these authors give considerable detail of their work (1937). The Finnish specimens were beaten from *Picea* on cool days.

KEY TO EUROPEAN SPECIES OF *EXENTERUS* HARTIG

1. Petiolar segment trisinuate (Fig. 40): hind tibia bearing a very minute spur: genal costa double, conformed much as in *Exyston genalis* Thoms. (Fig. 51): fore wings conspicuously clouded along fore margin . . *apiarius* Grav.

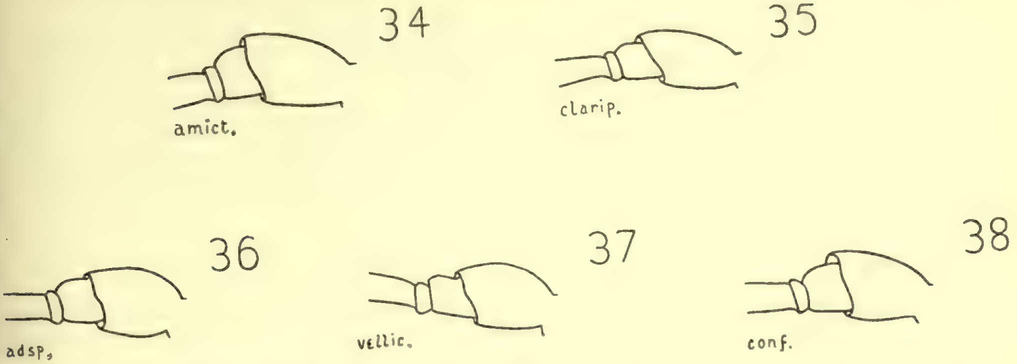
   Petiolar segment not thus trisinuate (e.g. Fig. 39): hind tibia without a minute spur: genal costa not double: wings hyaline, or moderately and evenly infumate 2

2. Clypeus broadly rounded at apex and neither transversely impressed nor reflexed: antennae in female barely half as long as body, in male much shorter than body: gaster broad, with tergite 2 much broader at base than long (in female nearly twice as broad as long): claws in female usually pectinate . . . . (*abruptorius* group) 3

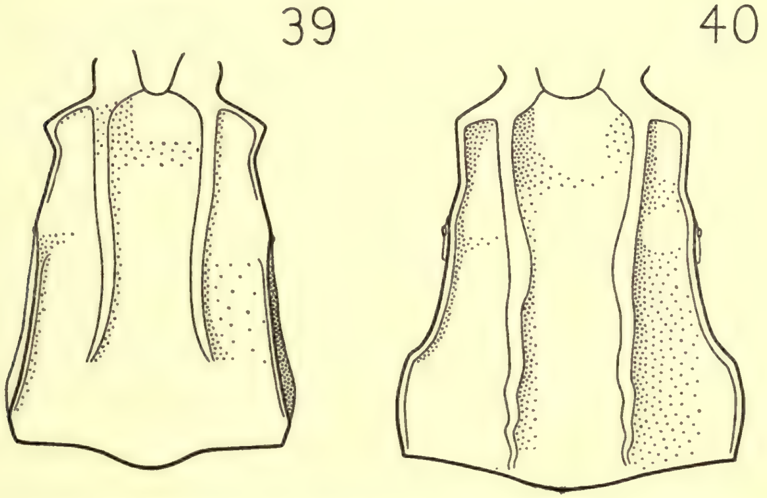
   Clypeus more or less distinctly transversely impressed before the strongly rounded and reflexed apex: antennae in female much more than half as long as body, in male nearly as long as body: gaster generally narrow, with tergite 2 nearly or quite as long as basally broad: claws in female not or weakly pectinate . . . . (*amictorius* group) 5

3. Margin of cavities of fore coxae not raised, except weakly at sides: in side view, greatest length of head behind eye a little less than eye length: malar space almost equal to distance between mandibular apices: gaster in female more than half yellow: mesosternum conspicuously yellow-marked: yellow of first tergite extending far towards base laterally . . . *oriolus* Hart.

   Margin of cavities of fore coxae raised: in side view, greatest length of head behind eye a little more than eye length: malar space only about half distance between mandibular apices: gaster in female more than half, and mesosternum black: yellow of first tergite not or little wider laterally than medially . . 4



FIGS. 34–38. Antennal scape, &c., in sinistro-lateral view, of Fig. 34. *Exenterus amictorius* Panz. Fig. 35. *Exenterus claripennis* Thoms. Fig. 36. *Exenterus adspersus* Hart. Fig. 37. *Exenterus vellicatus* Cushm. Fig. 38. *Exenterus confusus* sp. n.



FIGS. 39–40. Petiolar segment of Fig. 39. *Exenterus amictorius* Panz. ♀. Fig. 40. *Exenterus apiarius* Grav. ♀.

4. Margin of cavities of fore coxae not bidentate: claws in female pectinate: larger species, 8–11 mm. . . . . *abruptorius* Thunb.
 Margin of cavities of fore coxae strongly raised and strongly bidentate: claws simple: smaller species, 7 mm. . . . . . . *simplex* Thoms.
5. Gaster broad, as in *abruptorius* group, mainly chestnut-brown in colour, and with segments 1–2 strongly punctate but not rugose: costulae of propodeum absent, or weak and incomplete . . . . *ictericus* Grav.
 Gaster relatively narrow, as described before, black or black and yellow, and with

segments 1–2 strongly rugose-punctate (except in smallest specimens of some species): costulae of propodeum distinct 6

6. Margin of cavities of fore coxae raised. 7
Margin of cavities of fore coxae not raised, or only with traces of keels laterally 8

7. Margin of cavities of fore coxae bidentate, emarginate between the teeth and appearing discontinuous in middle: scape very weakly excised externo-ventrally (Fig. 34) . . . *amictorius* Panz. (= *marginatorius* Fabr.)
Margin of cavities of fore coxae not bidentate, appearing continuous and almost straight: scape rather weakly excised externo-ventrally (Fig. 35) . . . . *claripennis* Thoms.

8. Males: see discussion immediately following.
Females 9

9. Gaster laterally beyond tergite 3, genitalia and hypopygium rufo-castaneous: hypopygium very acute (Cushman, 1940, fig. B), and without a distinct, broad stramineous or white hind margin: head moderately to strongly narrowed behind eyes, not as in female *adspersus* Hart. . . . *tricolor* Roman
Gaster not laterally rufo-castaneous: hypopygium not as above . . 10

10. Temple strongly convex, nearly as long as short diameter of eye: hypopygium sharply folded and moderately acute (Cushman, 1940, Fig. A): third valvulae very distinctly projecting beyond apex of tergites 7 and 8 (they project slightly beyond in *tricolor* Roman but not in other described European species) . . . . *adspersus* Hart.
Not as above 11

11. Hypopygium pinched ventrally near apex, its lower margin in profile very strongly curved, its apex thin, wavy, broadly white (Cushman, 1940, fig. D): mesosternum and especially propodeum largely yellow-marked . . . . *vellicatus* Cush.
Hypopygium not at all as above, not dissimilar from that of *amictorius* (*marginatorius*) (Cushman, 1940, fig. C), though ovipositor sheaths broader than as there represented: mesosternum and propodeum not largely yellow-marked . . . . *confusus* sp. n.

SEPARATION OF MALES OF FOUR SPECIES

Whereas the species *adspersus* Hart., *tricolor* Roman, *vellicatus* Cush., and *confusus* nov. are clearly distinguishable in the female sex upon the form of the hypopygium and third valvulae, and certain other features, such good external characters are not available for the separation of the males. Thus I find that in male *adspersus* the head may be shorter and distinctly narrowed behind the eyes; and some males that I believe to be *vellicatus* Cush. have the gaster laterally rufo-castaneous as in *tricolor* Roman. This condition should be distinguished from that obtaining in some small specimens of other species, in which the whole gaster, except the yellow-coloured parts, is dull castaneous rather than black.

Taking specimens and the description of *confusus* nov. as a starting-point, the other species have been compared with these in both sexes. It is hoped that the resulting observations will enable the majority of specimens to be placed with confidence: the greatest difficulty appears to be the separation of males of *tricolor* Roman and *vellicatus* Cush.

E. adspersus Hart. differs from *confusus* as follows: lower face reticulate to some extent below antennae, but in greater part discretely punctate: clypeus finely to rather coarsely and rather sparsely punctate, on the average less strongly punctate than in *confusus*: scape somewhat strongly convex dorsally (Fig. 36): scutellum rather weakly to moderately convex, generally much more evenly so than in *confusus*, i.e. seldom falling at all abruptly behind: posterior face of propodeum more abruptly declived: propodeum more strongly, often quite strongly reticulate-rugose: yellow coloration of gena reaching hypostomal costa, and reaching or approaching genal costa: male mesoscutum more often, like that of female, with a pair of discal yellow marks between tegulae: propleura sometimes pale-marked: mid coxae and femora of male extensively pale-marked, as much so as on fore leg of *confusus*: hind coxae sometimes pale-marked beneath.

E. vellicatus Cush. is best compared with *adspersus*, with the colour differences of which from *confusus* it very much agrees, though the extent of genal coloration is often intermediate, as is the form of the scape (Fig. 37). Epistoma alutaceo-punctate, very little raised: notaulices a little more distinct than in *adspersus* or *tricolor*: sternaulices more distinctly impressed: mesosternum decidedly flattened, with mesolcus more sharply impressed, scarcely broadening behind: area pleuralis of propodeum weakly rugose behind and below (quite strongly so in *adspersus*). The head is often distinctly raised behind the ocelli, but unfortunately this is not invariably so. In female a yellow mark runs along the sternaulices, and in male there is usually a trace of this.

E. tricolor Roman differs from *vellicatus* as follows: scape weakly convex dorsally, as in *confusus*: epistoma not thus flattened, usually smooth between punctures: genal colour as in *adspersus* or intermediate, as in *vellicatus*: mesosternum and pleura as described for *adspersus*, but speculum extends farther forward and pleuron is more finely punctate in front of it.

Genus *EXYSTON* Schiødte

1839 *Exyston* Schiødte, *Guérin's Mag. Zool.* (2) **1:** 12 (separate pagination).
1877 *Tricamptus* (Förster) Woldstedt, *Bull. Acad. Sci. St. Pétersbourg*, **23**: 454.

Our knowledge of this genus in Europe has been in a most unsatisfactory condition. Unfortunately I have not examined the Gravenhorst types. The following specific names require consideration: *albicinctus* Grav., *albocinctus* Grav., *tricolor* Grav., *subnitidus* Grav., *cinctulus* Grav., *sponsorius* (Fabr. *non* Jurine) Grav., *carinatus* Thoms., *genalis* Thoms., *calcaratus* Thoms., *phaeorrhaeus* Hal., *pratorum* Woldst. = *brevipetiolatus* Thoms. = *triangulatorius* Hlgr. *non* Grav. (*Anisoctenion*).

Of the above I am, in the present work, making *calcaratus* Thoms. the type of a new genus, *Parexyston*.

One of the two commonest European species has probably been sufficiently characterized for its recognition, and has been best known as *brevipetiolatus* Thoms. Roman (1939) thought it to be *Cteniscus phaeorrhaeus* Haliday but, as will be shown below, that conclusion is now disproved. Hellén (1937) placed it in synonymy with *pratorum* Woldst.; and there is not, to my knowledge, any valid prior name.

The second of the two most common species, which is very variable in colour, has the genal costa continuous or almost so; a fact first recognized by Thomson (1883), who took it to be the typical species and placed it under Gravenhorst's name *cinctulus*. The type of *cinctulus* Grav. 1820 is not to be found in the Turin museum (see Kerrich, 1950), so a lectotype should be selected from the Gravenhorst collection at Wroclaw; but I accept the descriptions of 1820 and of 1829 as referring to this species, and I find no clear indication that any of the colour varieties described should refer to *genalis* Thoms. (see below). An intensive study of *cinctulus* Grav. confirms what had already been suspected, namely that the form described as *carinatus* Thoms. is within its limits of variation and is not specifically distinct.

Consideration must now be given to the name *sponsorius*. Pfankuch and Schmiedeknecht place *sponsorius* Grav. as a variety of *cinctulus*, but Gravenhorst attributed the name to Fabricius who would, of course, have priority. Dr. Kai Henriksen wrote to me that the type of *sponsorius* is not in the museum at Copenhagen. I am indebted to Kustos Dr. Olaw Schröder for information from Kiel. It is not known whether Pfankuch ever examined the Fabrician collection there. No specimen labelled *Ichneumon sponsorius* is present. The type of *Cryptus sponsor* is present, labelled in Fabricius's own writing: it is a female with a distinctly exserted ovipositor, and may well have been correctly identified by later authors. There is also a specimen labelled by Fabricius '*sponsatorius*': on this the mid and hind tibiae each bear two spurs, so it can be no Ctenisciné. It is a large species, about 15 mm. in length excluding appendages, and does not appear to agree with Fabricius's descriptions of *sponsorius*. It seems best to drop the name *sponsorius* unless or until another type can be discovered. *Exyston sponsorius* Grav. as identified by most later authors is a form of *cinctulus* Grav.; and I find no clear indication in Gravenhorst's descriptions that it could refer to any other species.

Thomson's diagnosis of *genalis* (1883: 883) was quite inadequate, and has failed to lead subsequent authors to its recognition. In his collection are three specimens, all female and all belonging to the species figured and redescribed as *genalis* in the present work. Unfortunately, no one of these can with assurance be selected as lectotype: one, however, is labelled 'coll. Ros.'; and since, as Dr. Kjell Ander informs me, Rosenschiöld collected in Västergötland, this specimen could be the type. Thomson's words, 'Long. 3–3½ lin. *E. cinctulo* colore statura et magnitudine simillimus', corroborate this interpretation of the species. I was able to tell A. Roman that this was the species placed as *genalis* in the Lund collection; and his acceptance of this is evidenced by the series he arranged in the Swedish collection at Stockholm. He had known the species as a species, and he told me he had recognized it among Förster's material in the Vienna museum under the manuscript names *apicalis* (♀) and *aberrans* (♂); but he had been misled by Thomson's diagnosis. The species he recorded as *genalis* from Kamtchatka (Roman, 1931) is another, nearer related to *pratorum* Woldst. (see below).

Until 1946, *albocinctus* Grav. and *tricolor* Grav. were both unknown to me, and I wondered whether they would prove to be mere forms of the variable *cinctulus* Grav., as other authors had supposed. Pfankuch examined the types and amplified the descriptions (1906). Later (1925: 57), he recorded both forms from North Slesvig; though he wrote of *albocinctus* 'Wohl nur ein Varietät von *E. cinctulus*'. Schmiedeknecht (1912) mentioned no record of either subsequent to those of Gravenhorst (1829), though de Gaulle listed both in his catalogue (1908).

H. G. M. Teunissen sent me a list of the Cteniscine species known to him to occur in Holland, including *Exyston albocinctus* Grav. He most kindly responded to my request for the loan of this species by sending a Dutch male taken in 1887, and since recorded (Teunissen, 1948). Though only about 7½ mm. in length and, in general, of rather paler coloration, this specimen agrees very well with the descriptions given by Gravenhorst and by Pfankuch. It is unquestionably a good species. The petiolar segment is, as stated by Gravenhorst, relatively less narrow than in *cinctulus*. I am pleased to acknowledge the credit due to Dr. Teunissen for the rediscovery of this species.

A small sending received shortly afterwards from R. Malaise contained another male of this species, bearing no determination label, and a female which I associated with it. Then I discovered that this female agrees very well with the descriptions of *tricolor* Grav. I have no hesitation in maintaining this association of the sexes, so *tricolor* Grav. falls in synonymy with *albocinctus* Grav. It may be objected that Gravenhorst recorded his specimen of *tricolor* as a male, and that Pfankuch did not disturb this interpretation; but 'vomeriform' third valvulae of a female Cteniscine are, when withdrawn, folded over, and they present an appearance very similar to that of a pair of male claspers. In such case the closest scrutiny is required to ensure correct sexing.

Specimens in de Gaulle's collection were unlabelled, but have now been rediscovered. Now that I know the species, I am satisfied that the description of *Ichneumon albicinctus* Grav. 1820 refers to it, though the type cannot be found in the Turin museum.

Cteniscus phaeorrhaeus Haliday was duly included by Morley, in the fourth volume of his monograph (1911: 207), under *Exenterus* (= *Exenterus*+*Cteniscus* as here accepted). When examining the Haliday collection in the Dublin museum two years later, Morley selected a lectotype, gave a brief description of it, and placed it next *Cteniscus mitigosus* Grav., but did not identify it with any species described elsewhere (1913: 261). At the same time he declared that the record given in his monograph was an error. Apart from a record by Haines (1931), the matter rested there until Roman (1939: 195), after correspondence with A. W. Stelfox, identified it with *Exyston brevipetiolatus* Thoms.

Upon my inquiring whether Roman's synonymy could be supported by fuller and more positive evidence than was contained in his rather brief note, Stelfox sent me Morley's lectotype for examination, and wrote that in his opinion it could not be the type, and that Roman had agreed with this. It is a female but, in other respects, fits Morley's diagnosis. It runs down in Schmiedeknecht's key to *Cteniscus dorsator* Thunb. (= *limbatus* Hlgr.), and fits the description of that form. It must be rejected as type of *phaeorrhaeus* Hal. since, as indeed is stated by Morley, the fore legs are not basally black, and the gaster is not fulvous at the apex but red discally and bright flavous banded near the apex. More than one twentieth-century specialist of repute has mistaken a female for a male Ctenisсine, yet Haliday recorded both sexes of *Ct. auriflums* and may be presumed to have distinguished them, especially as, so Stelfox tells me, he often dissected specimens when describing species. Furthermore, another female specimen of *dorsator* Thunb. in the collection bears the label '*cephalotes*' in Haliday's writing.

A. W. Stelfox has now given me the following fuller account of his correspondence with A. Roman. He sent a description and figure of Morley's lectotype, which Roman identified as *dorsator* Thunb. He had failed to find in Haliday's collection a specimen which could, in his opinion, be the type, so he sent from his own collection a male specimen of a species he had taken frequently in Ireland, had not identified with any other author's description, but thought most likely to be Haliday's *phaeorrhaeus*. Roman identified it with *brevipetiolatus* Thoms., and agreed with the conclusion. I have now seen the actual specimen and agree with the identification.

Indeed, the conclusion appeared highly probable. The species agrees with Haliday's description in the male sex diagnosed. It is of interest that the specimen recorded as *Exenterus phaeorrhaeus* from Woodstreet by Haines in his Hants & Dorset list (1931) does belong to *brevipetiolatus* Thoms. Haines used Morley's monograph, and the diagnosis there published, which Morley later (1913) declared to have been an error, seemed to me to refer to the same species. Mr. Morley kindly sent me the specimen on loan, which enabled me to confirm this supposition, and to see from a second label that he had placed the specimen correctly, later in 1911.

On first glancing at the box from the part of the Haliday collection relevant to the present study containing, among other Tryphoninae, the Cteniscini, I looked for *brevipetiolatus* Thoms. and caught sight of what I took to be a large dark male. Upon closer examination, I was astonished to find it was a male of a species I had received from Czechoslovakia from Professor Gregor, and which I had believed to be undescribed. This specimen I designate the type. The pinhead bears green sealing-wax: Haliday's mode of indicating an Irish insect. I have examined every Cteniscine in that box from which *brevipetiolatus* is absent and, in my view, no other specimen could possibly serve as type. Moreover, it fits Haliday's diagnosis even better than does *brevipetiolatus*: the fore and mid femora, except internally, and also the trochanters are distinctly ferrugineous, and the coxae are black or almost so. The hinder part of the gaster is much more outstandingly fulvous: in this respect the specific name may be taken as indirect supporting evidence, for 'phae-orrhaeus', as I am told by classical scholars at the University of Manchester, means 'bright-coloured rump'.

Finally it may be noted that Morley (1911) provided a false clue by misinterpreting Haliday's manuscript catalogue, in which there stands against *phaeorrhaeus* the mark for 'certainly Irish' but not the mark indicating 'common or in many collections'.

Tryphon subnitidus Grav. was placed in *Exyston* by Pfankuch (1906). Schmiedeknecht (1911), being unable to place the species, omitted mention of it; but Morley (1911) recorded it as British from an old specimen in the British Museum. This proves to be a small, dark male *Anisoctenion rubiginosus* Grav., as is a specimen so placed in the Melville-Bury collection, now in the Manchester Museum. C. Morley very kindly sent me on loan two specimens from the series taken by him in Suffolk in 1919 and recorded as *subnitidus* (1936), but these agree with my description of *Parexyston calcaratus* Thoms.

In 1949, when sorting specimens for the redescription of *phaeorrhaeus* Hal., I found that a second, closely related, species was mixed with them, represented by three specimens from Switzerland and one from Spain. At last a species had been discovered whose male I could reconcile with Gravenhorst's description and Pfankuch's diagnosis of *subnitidus*.

Exyston cinctulus Gravenhorst

1820 *Ichneumon cinctulus* Gravenhorst, *Mem. Accad. Sci. Torino*, **24**: 359–361.
1820 *Ichneumon sponsorius* Gravenhorst, ibid.: 362.
1829 *Mesoleptus cinctulus* Gravenhorst, *Ichneumonologia Europaea*, **2**: 37–41.
1839 *Exyston cinctulus* Schiødte, *Guérin's Mag. Zool.* (2) **1**: 12 (separate pagination).
1883 *Exyston cinctulus* Thomson, *Opuscula Entomologica*, fasc. 9: 882.
1883 *Exyston carinatus* Thomson, ibid.: 882–883.
1906 *Exyston cinctulus* Pfankuch, *Z. Hym. Dipt.* **6**: 21.

Head moderately to rather strongly narrowed behind eyes and strongly rounded; moderately emarginate behind: on inner orbits finely, on vertex and temples finely to moderately punctate, and on genae more coarsely so: epistoma more or less coarsely reticulate or rugose-punctate, occasionally in small specimens discretely punctate: upper face generally with a distinct median keel, reticulate-punctate to rugose. Clypeus normally not strongly transverse; rather sparsely beset with punctures of different sizes, fine to coarse; sharply delimited basally; narrowly to broadly rounded at apex. Malar space about equal to distance between mandibular apices in male, distinctly longer in female. Hypostomal costa strongly raised, the elevation extending well back towards foramen magnum: genal costa continuous (Fig. 50); strongly raised in female, less strongly so in male. A weak costa is generally developed, running outward from the hypostomal costa toward the genal; but this may be broken up into a series of transverse rugae.

Antennae with scape deeply excised externo-ventrally (Fig. 53); with postannellus about 1·9 times length of the following segment; with flagellum 28- to 37-, usually 32- to 34-segmented.

Pronotum with epomiae sharp and generally fairly strong; laterally rather finely to moderately, occasionally quite finely punctate above, finely punctate to rugose below. Propleura rather finely to moderately punctate. Mesoscutum rather weakly to strongly and evenly convex; with notaulices always indicated but extremely superficial; rather finely punctate medially, finely to very finely so laterally. Scutellum rather weakly to rather strongly convex; margined to near middle; rather coarsely punctate or rugose-punctate in front, finely reticulate-rugose behind. Mesopleura rather coarsely punctate in greater part, generally rather finely so on region of speculum: sternaulices of moderate strength, rather sharply impressed: mesosternum closely and finely punctate: epicnemial carina strongly raised in female, moderately or rather strongly so in male; undeveloped above sternaulices, medially emarginate: mesolcus moderately impressed, generally transcostate in male, closed behind. Propodeum with costae weak but normally complete; finely to moderately punctate and shining above, merging to rugose, especially on spiracular and posteromedial areas, but with area pleuralis usually discretely punctate: area superomedia usually distinctly longer than broad but sometimes subquadrate.

Gaster much more spindle-shaped than clavate. Petiolar segment generally elongate and slender, of female 2·2 to 3·0, usually 2·5 to 2·8, of male 1·8 to 3·0, usually 2·2 to 2·6, times length of its greatest breadth; bearing lateral hairs distinctly longer than half its least breadth; generally moderately to strongly auriculate basally, but occasionally rather weakly so; with dorsal keels usually not sharp, distinct for half to more than four-fifths length of segment; rather finely to moderately punctate above, often in part rugose-punctate. Sculpture of remaining tergites as described for *genalis* Thoms. (p. 376 below). Female third valvulae not vomeriform.

Fore wings with basal and disco-cubital veins convergent; with areolet shortly petiolate; with nervus parallelus emitted in middle of brachial cell. Hind wings with nervellus almost opposite, usually intercepted well above middle.

Hind femur varying considerably in proportion (Figs. 41–42), from 4·5 to 5·2 times length of its greatest breadth in Irish specimens alone. Tarsal claws not pectinate.

Length 6 to 11 mm.

Female. Head coloured as in *genalis* Thoms., but the yellow coloration less extensive behind eyes, the black not more remote from lower mandibular articulation than about length of malar space. Antennae coloured as in *genalis*; but with scape and pedicellus often dull ferrugineous marginally and below, and only the membrane conspicuously pale. Thorax coloured as in female *genalis*; but the yellow coloration generally a little less extensive around epicnemial carina and on pronotum, sometimes much more restricted on or even absent from those parts and beneath wing-base. Legs with the following bright flavous: hind coxae largely below, fore and mid coxae except at base, and trochanters and trochanterelli; the hind and sometimes the mid trochanters above and the hind trochanterelli are dark-marked; the coxae are otherwise black or infuscate, or in brighter colour-forms partly rufous: femora, tibiae and tarsi fulvous to rufous; with femora flavous at apex and hind tibiae conspicuously stramineous at base; with the following parts infuscate: fore and mid tarsi at apex and hind tarsi largely, hind tibiae at apex and before base, hind femora at base and before apex, and sometimes fore and mid femora slightly before base. Wings with stigma and costa ochreous and the other veins ferrugineous, more or less yellow at base.

Colour pattern of gaster essentially of the type described for *genalis*, but more diverse and irregular: frequently there is no infuscation on tergites 2–4, and in brightest females the petiolar segment is rufous, only a little infuscate in basal half: in darkest females the rufous and yellow colouring is rather indefinitely suffused with infuscation, but in darkest males the tergites are black or infuscate from base, the infuscation so spreading as to reduce the rufous colouring to a narrow region before the pale yellow part.

Male. Head coloured as in male *genalis* Thoms., or the pale coloration further reduced in varying degree: in extreme case the black invades the clypeus, and the facial pale marks are reduced to narrow orbital lines running to the upper mandibular articulation; but commonly the orbital marks broadened above the tentorial pits, and a central mark remaining on the epistoma. Thorax black; normally with tegulae wholly pale and scutellum conspicuously pale-marked at apex, and sometimes with metascutellum more or less obscurely pale-marked; but sometimes the tegulae are partly infuscate, and in darkest colour-forms the scutellar mark is absent or greatly reduced. Coxae on the average more infuscate: in brightest forms the hind coxae are yet broadly flavous below; but in darkest the fore and mid coxae are only a little pale at apex and the hind coxae not at all pale, and the rufous colouring of the hind femora and tibiae is largely replaced by infuscation.

Redescribed from the following material: IRELAND, S. Kerry, Coumloughra Reeks, 1 ♂, Darrynane, 1 ♀, Westmeath, Lough Owel, 1 ♂, Wicklow, Glenmacnass, 1 ♂, 1 ♀, Greystones, 1 ♀, Coan, 3 ♂♂, Kings River, 1 ♂, Co. Dublin, Glenasmole, 1 ♂, 1 ♀, 8.vi–15.vii, 1928–1937, A. W. Stelfox *et al.*: SCOTLAND, Ross-shire, Loch Duich, 1 ♂, 29.vi.1934, O. W. Richards: ENGLAND, unlocalized, 3 ♂♂, Stephens coll., 1 ♂, 1 ♀, Desvignes coll., 1 ♀, 1929–1930, F. S. J. Hollick; Devon, Lustleigh, 1 ♂, 7.vi.1933, R. C. L. Perkins; Monmouth, Trelleck Beacons, 1 ♂, 10.vi.1936, E. B. Britton & J. F. Perkins: BELGIUM, unlocalized, 11 ♂♂, 6 ♀♀, Cortenaeken, 1 ♂, C. Wesmael; Steenbrugge, 1 ♂, 24.v.1875, Vivier d'Oie, 1 ♂, 29.v.1886, St. Croix, 1 ♂, 22.viii.1871, Ath, 1 ♀, 19.viii.1876, Severin, 1 ♀, 10.viii.1899, J. Tosquinet: HOLLAND, Venlo, 1 ♂, 19.vi, 1 ♀, 20.vi.1942, H. G. M. Teunissen: SWEDEN, Skåne, Degaberga, 2 ♂♂, 3 ♀♀, 9–12.vii.1938, D. M. S. & J. F. Perkins: FRANCE, Central Massif, la Bourboule, 1 ♂, J. de Gaulle: SWITZERLAND, Geneva, Peney, 1 ♂, 4 ♀♀, 20.v.–10.vi, 1876–1889, 1 ♂, 20.viii.1889, Tournier; Champel, 1 ♂, 25.iv, 1 ♂, 18.vi, Buess; Valais, les Haudères, 1 ♂, 6–27.vi.1935, R. B. Benson; Engadine National Park, 2 ♂♂, 5 ♀♀, 6.vii–6.viii, 1919–1923, Ch. Ferrière: GERMANY, Berlin dist., 1 ♂, 3 ♀♀, Ruthe coll.; Bavaria, 1 ♂, 3 ♀♀, 7.vi, 1 ♀, 8.vi, 1 ♂, 15.vi, 1 ♀, 25.viii, 1 ♂ without data, Buchecker coll.; Erzgebirge, Görkau, 3 ♀♀, vii.1932, Th. Kupka; Schwerin, 1 ♀, 11.vi.1880, 1 ♂, 30.v.1884, S. Brauns; Celle, 1 ♂, 21.vi.1942, R. Hinz: CZECHOSLOVAKIA, Bohumin, 1 ♀, viii.1937, Th. Kupka: RUMANIA, 2 ♂♂, 1 ♀, M. Jaquet.

Further material seen: FINLAND, Tenala. 2 ♂♂, v. Essen; Jääski, 1 ♀, K. Valle; Taipalsaari, 1 ♂, W. Hellén: SWEDEN, good series from many parts in Stockholm museum; material under *cinctulus* and *carinatus* in Lund museum: GERMANY, Upper Bavaria, Berchtesgaden, 1 ♂, 30.v, 1 ♂, 30.vi, 1 ♀, 20.vi.1947, G. Heinrich: FRANCE, Maisons Laffitte, Fontenay, la Bourboule, &c., J. de Gaulle; Brout-Vernet, H. de Buysson; Haut-Rhin, Alpes Maritimes, A. Seyrig (altogether 24 specimens in Paris museum): AUSTRIA, Styria, Admont, Kaiserau, 1,200 m., 1 ♀, vi.1950, G. Heinrich: 60 further specimens in British Museum (Natural History).

An inordinately variable species. To decide whether it was a single species, the method adopted was to write a description first from the Irish material, which could be assumed to be conspecific; and then to modify this by reference to more than seventy other specimens, which was as diverse a collection as could be assembled.

Variational Tendencies

A dark form is found in Ireland, the west of England and Scotland, and the high Alps. This tends to have the clypeus rather broadly rounded at apex. An intermediate has been studied from southern Sweden, Degaberga, having the same data as the normal form; and also from La Bourboule, French Central Massif.

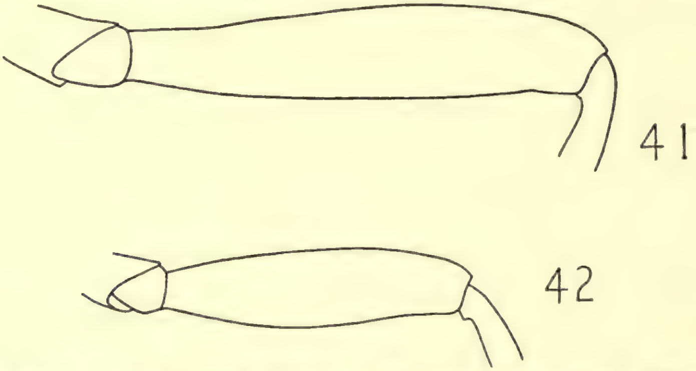
A brighter, stouter form is found in Holland, Belgium, Switzerland, and Bavaria. This has the head rather less narrowed behind the eyes, and the petiolar segment relatively less elongate.

Small specimens of the species tend to have the clypeus more transverse and the malar space a little shorter.

Exyston cinctulus Grav. ab. **approximatus,** ab. n.

Differs from the normal form of *cinctulus* in having genal costa approaching rather close to mandibular base but thereafter inflected (Fig. 49).

Russia: Samara (on R. Volga), 1 ♀, viii.1924, Lubischew (collection of A. Seyrig). Holotype in Museum d'Histoire Naturelle, Paris.



Figs. 41–42. Left hind femur, in outer side view, of *Exyston cinctulus* Grav. These illustrate the great intraspecific variation, and it is instructive to compare them with Figs. 16–17 (p. 327) of two species of *Anisoctenion*, where a good inter-specific difference is indicated. Fig. 41 is drawn from a female specimen from Czechoslovakia, and Fig. 42 from the type of ab. *approximatus* n. from Russia.

A second specimen has since been definitely attributed to this aberration: Finland, Tammerfors, C. Lundahl: this is a fine female specimen of 11 mm. length.

At first this was thought to be a good species, closely related to *cinctulus* Grav. but having secondary differences correlated with the primary character. When, however, *cinctulus* was studied intensively from a series of over eighty specimens, as diverse as could be obtained, it was found that the supposed differences of the Russian specimen were within or but little outside the great range of variation in *cinctulus* to the west of Russia.

Other specimens were found, with the genal costa inflected but the intervening space narrower. Yet other specimens have a mere trace of an inflected genal costa; and one particularly instructive specimen (in British Museum) has the genal costa split into an outer branch running almost normally as in Fig. 50 and an inner branch inflected in the manner of the aberration. It appears that in the normal form the genal costa, though having the condition described as continuous, continues towards the hypostomal costa as a lamina contiguous with the genal margin backing the mandibular articulation.

Exyston cinctulus Grav. subsp. **clavatus** Cresson

1864 *Ctenicus clavatus* Cresson, *Proc. Ent. Soc. Philadelphia*, **3**: 284.
1897 *Exyston clavatus* Davis, *Trans. Amer. ent. Soc.* **24**: 238.
1944 *Exyston clavatus* Townes, *Mem. Amer. ent. Soc.* **11** (1): 167–168.

Altogether less strongly hairy than the European form: genal costa not so strongly elevated or hairy: yellow coloration more extensive behind eyes: antennal scapes largely dull fulvous, with a yellowish spot beneath: flagellum also dull fulvous above in apical half: thorax more richly yellow-marked: propodeum decidedly tending to dull rufous (among European material I have only seen this in a few old specimens which may have suffered fading): coxae darkened to rufous only, not at all black: petiolar segment scarcely infuscate at base, but there is some infuscation on other tergites, particularly 3 and 4.

Diagnosis based on 1 ♀, Iosco Co., Michigan, 16–17.vii.1939, R. R. Dreisbach; det. H. K. Townes.

W. R. M. Mason kindly informs me that *clavatus* is very much less variable than the European form: also that it is evidently not an introduced species, for it is known from remote parts of northern Ontario; yet it is geographically isolated, being unknown west of the Rocky Mountains. These facts strengthen my belief that it is a true geographical sub-species.

He has since written that he agrees with my treatment of *clavatus*, and has sent me a further two females and a male for study. These substantially confirm the above diagnosis; but the male has the hind coxae and petiolar segment pale castaneous except at apex. He has recorded this new synonymy in the North American catalogue (1951 April: 229).

Exyston genalis Thomson

1883 *Exyston genalis* Thomson, *Opuscula Entomologica*, fasc. 9: 883 (*non* Roman 1931, *nec* Teunissen 1948).

Head rather strongly to strongly narrowed behind eyes; moderately emarginate behind: on vertex, temples and inner orbits rather finely to moderately punctate; on genae more coarsely, irregularly and in part confluently so: epistoma coarsely reticulate-punctate: upper face with a distinct median keel, moderately punctate, more or less rugose on triangle between median ocellus and antennal sockets. Clypeus rather strongly transverse, distinctly more so than in *cinctulus* Grav.; rather sparsely beset with punctures of different sizes, fine to coarse; rather deeply delimited basally; more or less narrowly rounded at apex. Malar space about equal to distance between mandibular apices in female, distinctly less in male. Hypostomal costa strongly raised, the elevation falling gradually to the foramen magnum. Genal costa strongly raised, double (Fig. 51): the outer costa almost continuous, the inner strongly inflected, meeting the hypostomal costa at the point where the latter is most strongly raised; the intervening space traversed by a series of ridges: outer and inner costae crenulate; usually both are upstanding in the female; but sometimes in that sex, and usually to a greater extent in the male, the inner costa is bent outward, so that the intervening space is in varying degree narrowed.

Antennae with scape weakly excised externo-ventrally (Fig. 54); with postannellus about 1·8 times length of the following segment; with flagellum 31- to 37-segmented.

Pronotum with epomiae of moderate strength; laterally moderately punctate above, finely punctate to rugose below. Propleura moderately, or rather finely and closely punctate. Mesoscutum strongly and almost evenly convex; with notaulices very superficial and not clear-cut; more or less finely punctate medially, very finely punctate and shining laterally. Scutellum moderately convex; rather finely to moderately and often rather closely punctate (in the specimen from the Tatra Mts. largely rugose); not margined to middle. Mesopleura moderately punctate, in part rugose-punctate, in front; more finely punctate behind: sternaulices quite distinctly, though seldom strongly, impressed: mesosternum densely and very finely punctate: epicnemial carina strongly raised, indistinct above sternaulices, medially emarginate but not nearly interrupted: mesolcus very sharply impressed, partly closed behind. The male differs in having the epicnemial carina only moderately raised, and the mesolcus more or less distinctly transcostate, not sharply impressed. Propodeum with costae rather weak but normally complete, though area basalis sometimes incompletely delimited apically; with area pleuralis finely and closely punctate; elsewhere more or less finely rugose.

Gaster distinctly clavate. Petiolar segment elongate and slender, 2·5 to 3·1 times length of its greatest breadth near apex; bearing lateral hairs distinctly longer than half its least breadth; weakly or moderately auriculate basally; with dorsal keels rather sharp, distinct for quite three-quarters length of segment; almost smooth between the keels, finely punctate and obsoletely rugose beside and behind them. Tergite 2 distinctly raised on mid line at base, and impressed to either side of this elevation; rather finely to moderately punctate and often rugulose on basal half. Remainder of gaster more and more finely punctate. Female third valvulae small, vomeriform.

Fore wings with basal and disco-cubital veins strongly convergent; with areolet usually shortly petiolate but sometimes sub-sessile or sessile; with nervus parallelus emitted in middle of brachial cell. Hind wings with nervellus almost opposite, intercepted a little above middle.

Hind femur 4·1 to 5·2 times length of its greatest breadth. Tarsal claws not pectinate.

Length 6 to 10 mm.

Female. Head black above a line running roughly transversely around, just below antennal sockets and foramen magnum; below this line stramineous to flavous, the pale coloration also extending some way up orbits of upper face: mandibles concolorous except at apex. Antennae with scape, pedicellus and postannellus mainly black, the scape almost always conspicuously pale-marked below: with annellus castaneous; beyond postannellus changing to ferrugineous above, dull fulvous below. Thorax black, with the following parts pale-coloured as on head: propleura mainly, ventral margins of pronotum at sides (the marks sometimes interrupted), region of epicnemial carina with backward extensions on sternaulices and beside mesolcus, small marks below wing-base, tegulae, mark at apex of scutellum and usually another on metascutellum. Legs rufous; with trochanters and trochanterelli, fore and mid coxae mainly, and hind coxae nearly always below, bright flavous; with knees rather indefinitely pale flavous; with the following parts infuscate: hind tarsi, hind tibiae at apex and before base, and hind femora before apex and at base: hind coxae generally in greater part black and usually rufous-marked, but sometimes in greater part rufous. Wings with veins and stigma pale ferrugineous, more or less yellow at base. Petiolar segment back, with a small pale mark at mid apex. Remainder of gaster normally mainly rufous; with tergite 2 black at base and sides, and with lateral black marks at base of tergites 3 and 4; with tergites having ill-defined but successively broader pale yellow apical margins, which occupy most of tergites 6 and 7: the yellow coloration may be more extensive, or the pale parts of the tergites may be to a greater or lesser extent overspread with infuscation.

Male differs as follows. Black coloration more extensive, reaching behind eye to a line between eye and lower articulation of mandible; often developed at mid base of mandible, along clypeo-frontal suture, and extending farther on to epistoma: orbits of upper face not pale. Scape with pale mark smaller or almost undeveloped. Thorax black, with tegulae usually wholly or partly pale, but without other pale marks. Fore and mid coxae to a large extent black or blackish at base: hind coxae almost entirely black. Yellow margins of tergites narrower and often more sharply defined: in one specimen from Bavaria tergites 2 to 6 mainly black above, with just a trace of rufous colouring on 3 and 4.

The male specimen from the French Ardennes has much of the female structure and coloration. This species is illustrated on Pl. 5.

Redescribed from the following material: NORWAY, Sognsvatnet, Aker, 1 ♀, 31.vii.1935, T. Soot-Ryen (mus. Stockholm, recorded as *E. sp. ign.* by Roman, 1942: 14): SWEDEN, Dalarne, 1 ♂, 16.vii, A. Roman; Dalarne, Orsa W., 1 ♀, 5.viii.1938, G. J. K.: FINLAND, Keuru, 1 ♂, J. Sahlberg; Karislojo, 2 ♂♂, 11.vi.1934, R. Krogerus; Ruovesi, 1 ♂, 26.vi.1931, V. Saarinen; Tampere, Aitolahti, 1 ♂, 26.vi, 1 ♀ 28.vi.1933, A. Saarinen; Kuusamo, 1 ♂, 6.vii. 1935, R. Krogerus; Kuusamo, Ruskeakallio, 1 ♂, 17.vii.1935, R. Krogerus, 1 ♀, 26.vii.1935, G. J. K.: SWITZERLAND, Nyon, 1 ♀, Cheyr: FRANCE, Ardennes, Verdun, 1 ♂, 10.viii.1925, Benoist: BELGIUM, Severin, 1 ♂, 22.vi.1899, Bastogne, 1 ♂, 23.viii.1887, J. Tosquinet: GERMANY, Schwerin, 1 ♀, viii.1887, S. Brauns (Nat. Mus. Ireland); Köln, 1 ♀, vii.1945, Aerts; Goslar, 1 ♀, 21.viii.1945, Celle, 1 ♀, 26.vii.1942, R. Hinz; Berlin dist., 1 ♂, Ruthe coll.; Oderberg-Liepe, 1 ♀, 19.viii.1938, G. J. K.; Bavaria, Erzgebirge, Görkau, 1 ♀, 11.vi.1932, Th. Kupka: MIDDLE EUROPE (unlocalized), 1 ♀, 4.vii.1900, R. von Stein coll.: CZECHOSLOVAKIA, Bohemia, Chodau, 1 ♂, 10.vi.1878, R. von Stein coll.; Erzgebirge, Aussig, 1 ♀, 11.vi.1932, Th. Kupka: POLAND, Tatra Mts., Zakopane, 1 ♂, 28.vi.1932, D. Aubertin & E. Trewavas.

Additional material seen: ITALY, Liguria, 1 ♀ in Spinola coll. in Turin museum:

GERMANY, Bodmann am Bodensee, 1 ♂, 25.v., 1 ♂, 18.vi.1949; Bildhausen, Krs Kissingen, 1 ♂, 15.viii, 1 ♀, 22.viii.1946; Holstein, Trittau, 1 ♂, 3.vii.1946, G. Heinrich: HOLLAND, Hulshorst, 1 ♂, 26.vi.1935, Lindemans: SWEDEN, Stockholm mus. coll., good series from wide range of latitudes; Thomson coll., 1 ♀, unlocalized, Rosenschiöld (possibly the type); 1 ♀, province Närcke; also 1 ♀ 'Finl.' (presumably from Finland).

Since the above was written, I have seen the series of 30 ♂♂, 12 ♀♀ taken in Styria, Austria, by G. Heinrich in June–July 1950. These confirm the characters used in my two keys to species of the genus.

Exyston phaeorrhaeus Haliday

1838 *Tryphon* (subgenus *Ctenisсus*) *phaeorrhaeus* Haliday, *Ann. Mag. nat. Hist.* (1) **2**: 113 (*non* Morley 1911, *nec* Morley 1913, *nec* Roman 1939).

Head rounded and strongly narrowed behind eyes; moderately emarginate behind: between ocelli and eyes rather coarsely and sparsely punctate; before occiput very finely punctate above; on temples and cheeks for the most part moderately punctate; on inner orbits more densely so, and on malar space more finely and much more densely punctate: epistoma reticulate-punctate to rugose: upper face in middle more or less trans-rugose, with a median keel that is often distinctly bifurcate before median ocellus. Clypeus smooth in contrast with the epistoma; sparsely beset with punctures of different sizes, fine to coarse; rather deeply delimited basally; weakly convex; rather narrowly to rather broadly rounded apically. Malar space at least four-fifths distance between mandibular apices, the gena distinctly angularly raised before mandibular articulation. Genal costa (Fig. 52) laminate, running forward to a point, then deeply emarginate before it again runs forward to meet the hypostomal costa, which is raised to a sharp point well forward. Outer genal costa bulging strongly outward, seen in frontal view as in Fig. 43, the bulge forming a very distinct angle with the normal plane of the gena. Between inner and outer costae is a cavity, traversed by a costa running outward from below point of inner genal costa, and usually a weaker one dorsal to this (below it in Fig. 52). The keel that, in this view, descends from the point of the hypostomal costa runs close behind the lower articulation of the mandible and appears almost to close the cavity in front.

Antennae with scape strongly excised externally (Fig. 56); with pedicellus strongly rounded internally, as seen from above; with postannellus about 1·5 times length of following segment; with flagellum 25- to 28-segmented.

Pronotum with distinct shining dorsal furrow; with epomiae rather strong and sharp; laterally finely punctate above, more or less longitudinally rugose below. Propleura smooth and very finely punctate. Mesoscutum very strongly convex though somewhat flattened discally; with notaulices very weak but distinct, extending almost as far back as hind end of tegulae; finely punctate between notaulices, sparsely and very finely punctate at sides. Scutellum rather weakly to rather strongly convex; not margined to middle; rather finely to moderately punctate, densely so behind. Mesopleura with longitudinal rugosities just behind those on pronotum; otherwise moderately punctate below, sparsely and finely so above: sternaulices shallow, punctate or rugose-punctate: mesosternum finely punctate, near mid line rather closely, laterally rather sparsely so: mesolcus moderately deeply impressed, broad and transcostate, closed behind: epicnemial carina strongly raised near mid line, medially deeply incised, thus bilobed; laterally moderately raised, disappearing just above lower angle of pronotum.

Propodeum with costae strong; with areae externa, basalis and superomedia shining and very finely punctate; with area pleuralis often mainly reticulate-rugose, and with other areae rather strongly rugose: area basalis generally delimited apically, falling sharply forward between strongly raised keels: area posteromedia elongate, extending forward far beyond middle.

Gaster strongly clavate. Petiolar segment 2·0 to 2·4 times length of its greatest breadth; moderately auriculate basally; with dorsal keels distinct, sometimes to near apex; sharply raised from margins to keels, flattened, sometimes slightly concave, between the keels; rather obscurely punctate medially near apex, elsewhere obscurely rugose. Tergites 2 to beyond middle and 3 at base closely beset with punctures of moderate strength on an alutaceous background, the interspaces tending to form longitudinal rugulosities: tergite 2 appreciably raised medially at base: thyridia sharply outlined and conspicuous, almost semicircular. Remainder of gaster normally finely punctate. Female third valvulae small, vomeriform.

Fore wings with basal and disco-cubital veins convergent, generally very slightly so; with areolet varying from distinctly petiolate (as in type) to sessile; with nervus parallelus emitted about in middle of brachial cell. Hind wings with nervellus slightly antefurcal, intercepted about in middle.

Tarsal claws with such stout hairs as to suggest pectination.

Length 5½ to 7 mm.

Female. Head black, with the following parts dull yellowish-ivory: palpi, mandibles except at apex and medially at base, clypeus, lower face except for a transverse line below antennal sockets, and genae largely. Antennae dull fulvous to ochreous beneath, with a few basal segments mainly black; more extensively black above, and becoming paler more gradually towards apex; with scape at apex above, annellus and extreme base of post-annellus castaneous. Thorax black, with scutellum at apex, propleura, and usually the lower angle of pronotum, yellowish-ivory; with tegulae sometimes pale castaneous behind. Legs mainly castaneous to black, with trochanters and femora pale at extreme apex: fore and mid legs with coxae and trochanters mainly yellowish-ivory anteriorly and femora and tibiae mainly flavous anteriorly. Wings with veins and stigma ferrugineous, basally paler. Gaster with petiolar segment black; with tergites 2 to 4 dull castaneous to black, with pale apical margins, and usually largely fulvo-castaneous at sides; with tergites 5 or 6 and following much paler, generally bright flavous: sternal region flavous to fulvous.

Male differs as follows. Head black, with palpi dull fulvous; with mandibles pale-coloured across middle: clypeus black at sides and more or less broadly inside suture, otherwise ivory-white, except that in type it is broadly fulvo-castaneous at apex. Thorax without any pale marks. Legs coloured as in female, but the coxae and trochanters are not pale except at extreme apex.

Redescribed from the following material: IRELAND, unlocalized, type ♂, A. H.

Haliday: ENGLAND, unlocalized, 1 ♂, 1907; Devon, Dartmoor, 3 ♂♂, 22.vi.1935, Lydford, 1 ♀, 20.vi.1944, R. C. L. Perkins: HOLLAND, Den Dungen, 1 ♂, 15.v.1942, H. G. M. Teunissen (Teunissen, 1948, under *E. genalis* Thoms.): SWITZERLAND, Geneva, Peney, 3 ♀♀, 28.v.1884, 1 ♀, 1886, 1 ♀, 5.vi.1889, Tournier; Champel, 1 ♀, coll. Buess; CZECHOSLOVAKIA, Moravia, Brno Hády, 1 ♀, 13.vi.1936, A. Hoffer.

Further material seen: FRANCE, Paris district, St. Michel, O. Sichel; Haut-Rhin, 30.v.1920, A. Seyrig (4 specimens in mus. Paris): GERMANY, Schleswig, Kiel, 1 ♂, 22.v.1949, G. Heinrich: AUSTRIA, Styria, Admont district, 1,200 m., on *Alnus incana*, 1 ♀, 25.vi.1950, G. Heinrich: TURKEY-in-Europe, Istanbul, 1 ♂, coll. de Gaulle; this is a peculiar specimen, with the spiracular tubercles of the petiolar segment sharp and very prominent.

Exyston subnitidus Gravenhorst

1829 *Tryphon subnitidus* Gravenhorst, *Ichneumonologia Europaea*, **2:** 144–145 (*non* Morley 1911, *nec* Morley 1936).

1906 *Exyston subnitidus* Pfankuch, *Z. Hym. Dipt.* **6:** 90.

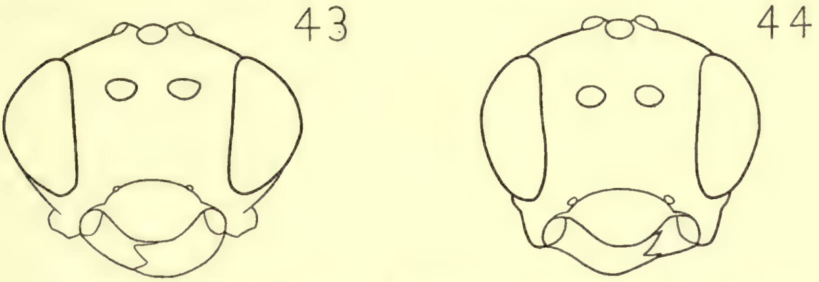
This species is closely related to, but much less strongly hairy than, *phaeorrhaeus* Hal.

Head rounded and rather strongly narrowed behind eyes (decidedly less so than in *phaeorrhaeus* Hal.); moderately and rather angularly emarginate behind: before occiput finely punctate above; on temples and cheeks for the most part moderately punctate, sparsely so between eyes and ocelli; on inner orbits rather finely punctate and on malar space densely so: epistoma of female rather finely punctate above to rather coarsely so below, on an alutaceous background, the punctures for the most part well separated; of male reticulate-punctate to rugose, the punctures not well separated except in mid line: upper face with median keel absent or very short; rather coarsely punctate, the punctures for the most part well separated. Clypeus as described for *phaeorrhaeus* Hal. Malar space about three-quarters distance between mandibular apices, the gena not angularly raised before mandibular articulation. Genal region of the type described and illustrated (Fig. 52) for *phaeorrhaeus* Hal., differing as follows: outer costa seen in frontal view as in Fig. 44, not forming a very distinct angle with the normal plane of the gena, not bulging so strongly outward, so that the genal cavity is less wide: inner costa running forward to a sharper point, but incomplete internally, so that the cavity is partly open behind: hypostomal costa more strongly and laminately raised, distinctly bent outward: the keel that arises from point of hypostomal costa does not run very close behind mandibular articulation nor appear to close the cavity in front: the keel that crosses the cavity from point of genal costa itself raised to a point.

Antennae with scape weakly excised externo-ventrally (Fig. 57); with postannellus about 1·7 times length of the following segment; with flagellum 25- to 27-segmented.

Pronotum as described for *phaeorrhaeus* Hal., but laterally moderately punctate above. Propleura rather finely punctate. Mesoscutum rather strongly convex; with notaulices scarcely traceable; medially rather finely punctate, at sides more finely and anteriorly densely so. Scutellum strongly convex; rather finely to moderately punctate; not margined to middle. Mesopleura not much rugose anteriorly; moderately punctate above, rather coarsely so below, and closely so almost throughout; sternaulices broad and rather shallow and, like the mesosternum, rather finely and closely punctate: mesolcus rather deeply and sharply impressed, closed by an incised ridge behind: epicnemial carina much as described for *phaeorrhaeus* Hal. Propodeum with costae moderately strong: finely to very finely punctate above, moderately so on area pleuralis: area basalis not falling sharply from apex: area posteromedia rugose, not elongate as in *phaeorrhaeus* Hal. and thus not extending far beyond middle.

Gaster not strongly clavate as it is in *phaeorrhaeus* Hal. Petiolar segment 2·0 to 2·1 times length of its greatest breadth; moderately auriculate basally; with dorsal keels not distinct to near apex, nor marking such an abrupt change of slope as in the previous species; conspicuously punctate, or in part rugose-punctate, in apical two-thirds. Tergite 2, like those following, normally finely punctate and shining; almost evenly convex between the thyridia, which are not very conspicuous. Female third valvulae weakly vomeriform.



FIGS. 43–44. Head in facial view of Fig. 43. *Exyston phaeorrhaeus* Hal. Fig. 44. *Exyston subnitidus* Grav.

Fore wings with basal and disco-cubital veins extraordinarily strongly convergent, so that a continuation of the lower abscissa of the disco-cubital, from point of ramellus, would meet the stigma before the point of emission of the radius; with areolet very distinctly petiolate; with nervus parallelus emitted slightly below middle of brachial cell. Hind wings and tarsal claws as described for *phaeorrhaeus* Hal.

Length 6 to 7 mm.

Female. Head coloured as in female *phaeorrhaeus* Hal., but the pale coloration more distinctly yellowed and rather less extensive; region of tentorial pits black. Antennae mainly black at base; to some extent paler towards apex above; in greater part dull fulvous below. Thorax black, with scutellum near apex, tegulae, and lower angle of pronotum yellowish-ivory: propleura black with inner margins flavous, or flavous with outer margins black. Gaster mainly castaneous, or with petiolar segment and bases of following tergites blackish: tergites somewhat paler at sides. Wings with costa yellow, with other veins and stigma more or less ferrugineous, paler at base.

Male. Head coloured as in male *phaeorrhaeus* Hal., but neither specimen before me has more than a sub-triangular apical mark pale on clypeus. Thorax black with tegulae more or less castaneous. Tergites 2 and following with distinct pale margins, these becoming broader and paler towards apex, which is mainly bright flavous.

Legs coloured much as in *phaeorrhaeus* Hal., sex for sex; but the mid and hind coxae and the trochanters are blackish, a little paler beneath.

Redescribed from the following material: SWITZERLAND, Engadine national park, Zernetz dist., 1 ♀, 25.vii.1921, 1 ♂, 23.vii.1922, Grupshum, 1 ♂, 18.vii.1925: SPAIN, Valle de Ordesa, 1 ♀, viii.1931, J. M. Dusmet.

Exyston albicinctus Gravenhorst

1820 *Ichneumon albicinctus* Gravenhorst, *Mem. Accad. Sci. Torino,* **24**: 375 (*non Ichneumon albicinctus* Gravenhorst 1829 = *Barichneumon locutor* Thunb.).

1829 *Tryphon albocinctus* Gravenhorst, *Ichneumonologia Europaea,* **2**: 204–205, **syn. n.**

1829 *Tryphon tricolor* Gravenhorst, ibid. **2**: 207–208, **syn. n.**

1878 *Exyston cinctulus* ♂ var. Brischke, *Schrift. naturf. Ges. Danzig,* **4**: 106.

1906 *Exyston albocinctus* Pfankuch, *Z. Hym. Dipt.* **6**: 222.

1906 *Exyston tricolor* Pfankuch, ibid. **6**: 223.

Head slightly narrowed or very slightly broadened behind eyes, and then strongly rounded; shallowly or rather shallowly emarginate behind: from level of lateral ocelli shining, with temples rather finely punctate: genae moderately to rather coarsely punctate, the punctures in many cases separated by less than their own diameters: malar space and inner orbits rather finely punctate: lower face coarsely, and in large specimens very closely punctate, the punctures somewhat squashed out of shape by their mutual proximity: upper face very closely beset with moderate punctures, often almost trans-rugose between antennal bases and median ocellus, and with a median keel running to the median ocellus. Clypeus irregularly punctate, rather coarsely so above, rather finely and sparsely so below; scarcely convex; very superficially, and very seldom at all sharply, delimited basally, and not set distinctly at an angle with lower face; apically distinctly bi-tuberculate. Malar space about equal to or, more usually, less than distance between mandibular apices in male, about one-fifth greater than such distance in female. Genal costa moderately raised; inflected much as in *pratorum* Woldst. (Fig. 48), but more angularly so in female: the gena not angled between costa and mandibular base, in position where in other species there is an outer costa. Hypostomal costa, where met by genal, bent outwards and raised rather to a point.

Antennae with scape (Fig. 55) moderately excised externally; with postannellus about twice length of the following segment, both measured along inner margin: flagellum 31- to 35-segmented.

Pronotum with epomiae of moderate strength or rather weak, not sharp; laterally moderately punctate above, closely punctate to rugose-punctate below. Propleura moderately and closely punctate, but rather sparsely so in the small specimen from Finland. Mesoscutum moderately and almost evenly convex; with notaulices not clearly indicated; finely to moderately punctate, sparsely so across disk, more closely so in front and behind. Scutellum rather strongly and evenly convex, though sometimes slightly buckled; rather coarsely and closely punctate; not distinctly margined beyond basal furrow. Mesopleura in front coarsely and closely punctate, often in part rugose-punctate; behind more moderately and less closely punctate, but without a distinct impunctate speculum: sternaulices broad but generally superficial: mesosternum densely and rather finely punctate: epicnemial carina moderately raised between and along fore margin of sternaulices, then with margin curving inward; medially emarginate: mesolcus sharply impressed, often weakly transcostate, with either a strong costa closing it behind or else a series of weaker transverse costae in that position. Propodeum with areolation weak and incomplete in middle; in particular, the area superomedia is not or very indistinctly bordered basally and laterally, and the costulae are usually incomplete though always indicated: area posteromedia well bordered and transversely rugose: area angularis longitudinally rugose: area pleuralis moderately and rather closely punctate: area externa more finely and other lateral areas more coarsely punctate, all less closely so: area superomedia represented by a more or less distinctly shining patch, impunctate or sparsely punctate, often flanked by weak transverse rugosities.

Petiolar segment of female 2·2 to 2·3 times, of male 1·9 to 2·1 times length of its greatest breadth; very strongly auriculate at base; with dorsal keels distinct in about basal third of segment, thereafter not or scarcely indicated in male, though with clearer indications in female; for the most part moderately punctate, but in middle third between positions of keels shining, and not or sparsely punctate. Remainder of gaster with tergite 2 discretely and for the most part moderately punctate; with remaining tergites more and more finely punctate towards apex. Female third valvulae vomeriform.

Fore wings with basal and disco-cubital veins strongly convergent; with areolet distinctly petiolate; with nervus parallelus emitted below middle of brachial cell. Hind wing with nervellus almost opposite, intercepted about in middle.

Tarsal claws not pectinate.

Length 6½ to 11½, normally 8 to 10 mm.

Female. Head black above a line running roughly transversely around, just below antennal sockets and foramen magnum; below this line ivory-white, much modified by flavous or fulvous, the pale coloration also extending some way up orbits of upper face: mandibles concolorous except at apex. Antennae with scape, pedicellus and postannellus mainly black, the scape conspicuously pale-marked in apical half below; with annellus mainly castaneous; with remainder of flagellum fulvous, ferrugineous for a short distance at base beneath and a much greater distance above. Thorax black, with the following parts pale-coloured as on head: pronotal collar, widely near hind angles, propleura totally, tegulae, small mark below fore wings and hind margin of mesopleura narrowly above, and large apical marks of scutellum and metascutellum; also on mesothorax a pair of marks that go broadly down lower halves of fore margins of pleura, then narrow on upper halves of sternaulices, then greatly broaden along fore margin of mesosternum, then continue more narrowly backward beside mid line to closure of mesolcus. Legs with the following parts pale flavous: coxae, trochanters and trochanterelli, fore and mid femora anteriorly, and knees; with fore and mid femora behind, and with hind femora fulvous to castaneous; with tibiae and tarsi flavous to fulvous, the tarsi somewhat darkened, and the hind tibiae darkened above near apex and with a broad darker ring near base; with dark marks on femora, hind trochanters and mid coxae at base, and with hind coxae mainly almost black above. Wing veins pale ferrugineous, except for the yellow costa: stigma ochreous. Petiolar segment black, with a median apical spot coloured as on following: remainder of gaster bright, pale fulvo-castaneous, the tergites more and more broadly margined apically and laterally with yellowish-white, tergites 6 and 7 being mainly so coloured, but the colour margins are not sharply defined: tergite 2 blackish at base, with yellow thyridia: sterna mainly yellowish.

Male differs as follows. Head for the most part black, including a very broad band inside basal margin of clypeus; with pale colour on remainder of clypeus, on middle and along basal margins of mandibles, and on maxillary and labial palps. Antennal scape without a pale mark beneath, or with an inconspicuous mark that does not reach apex of segment. Thorax black; with a small pale apical mark on scutellum, and sometimes an obscurer one on metascutellum: tegulae partly ferrugineous. Legs coloured as in female, but with fulvous coloration darkened; with coxae wholly or for the most part, trochanters usually in part and hind femora behind, black or almost so. Gaster coloured as in female, but usually tergites 3 to 5 are blackish at base and tergite 2 more than half black: the palest coloration is always less extensive and often more yellow.

Redescribed from the following material: BELGIUM, Steenbrugge, 1 ♂, 24.v.1875, Ghlin, 5 ♂♂, 17.vi.1877, Mont l'Enclus, 1 ♂, 26.v.1893, J. Tosquinet: HOLLAND, Exaeten, 1 ♂, vi.1884, 1 ♂, 5.vi.1887, A. Wasmann: GERMANY, Schwerin, 1 ♂, 11.vi.1889, S. Brauns: SWITZERLAND, Geneva, Peney, 1 ♀, 29.v.1876, 1 ♂, 5.vi.1889, 1 ♂, 20.vi.1889, Tournier; Champel, 1 ♂, coll. Buess; without data, 1 ♀: HUNGARY, Jászberény, 1 ♀, Moczar (mus. Stockholm): FINLAND, Åbo district, Uskela, 1 ♂, E. J. Bonsdorff, coll. Mäklin: EUROPE, unlocalized, 1 ♂ bought from Staudinger (Brit. Mus.).

Additional material seen: FRANCE, Paris district, Maisons-Laffitte, Rueil, Nantesse; Varennes, St. Baume, J. de Gaulle (4 specimens in mus. Paris): GERMANY, Crefeld, 1 ♀, vi.1928, A. Ulbricht.

Originally described from Piedmont, Italy, and the female synonym from the Rhineland. Brischke's insect was from the Danzig district: from his diagnosis I have no doubt that it belonged to this species. Evidently a very scarce species: Morley has already, quite rightly, rejected Stephens's British records.

Exyston sp.

1931 *Exyston genalis* Roman, *Ark. Zool.* **23A** (6): 14 (*non* Thomson 1883).

It is thought desirable to correct an existing record, but inopportune to validate this species with a name based on a single imperfect male. In order, however, to stimulate the search for further specimens, and to increase our understanding of the genus as a whole, the species has been separated in my key to palaearctic species, and is here further diagnosed.

A larger, more elongate species than *pratorum* Woldst.: length of unique male 10 mm. Upper face reticulate-punctate, not rugose. Clypeus sharply delimited basally. Malar space a little less than distance between mandibular apices. Postannellus 1·7 times length of following segment. Pronotum laterally moderately punctate above. Notaulices short and extremely superficial. Mesopleura coarsely punctate in front. Propodeum with costae normally complete and rather strong. Petiolar segment about 2·5 times length of its greatest breadth; weakly auriculate basally; with dorsal keels strong and almost percurrent. Tergite 2 reticulate-rugose in basal half, thereafter rugose-punctate. Fore wings with basal and disco-cubital strongly convergent. Tarsal claws not pectinate.

So closely related to the nearctic *E. boreotis* Davis (of which I have seen two pairs determined by H. K. Townes) that I thought it might be a form of that species. In the American specimens, however, the temples are finely or rather finely punctate; whereas in the Siberian they bear coarse punctures separated by less than their own diameters. I have been allowed to submit the specimen to W. R. M. Mason, who is of the opinion that it is not *boreotis* Davis but that, like that species, it belongs to the group of *variatus* Prov.

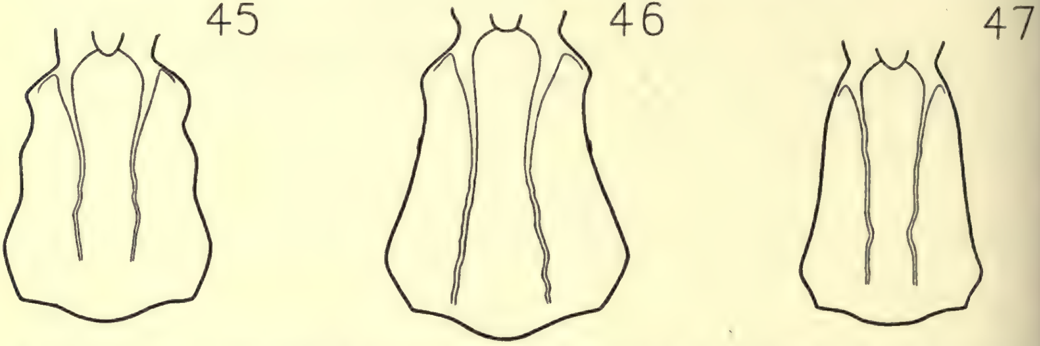
Exyston pratorum Woldstedt

1858 *Exenterus triangulatorius* Holmgren, *Svensk Vet.-Akad. Handl.* **1:** 235 (*non* Gravenhorst 1829).
1874 *Exenterus pratorum* Woldstedt, *Bidr. Känn. Finl. Natur Folk*, **21:** 52–53.
1877 *Cteniscus* (*Tricamptus*) *pratorum* Woldstedt, *Bull. Acad. Sci. St. Pétersbourg*, **23:** 454.
1883 *Exyston brevipetiolatus* Thomson, *Opuscula Entomologica*, fasc. 9: 883 (synonym by Hellén 1937).
1911 *Exyston brevipetiolatum* Morley, *The Ichneumons of Great Britain*, **4:** 192–193.
1911 *Exenterus phaeorrhoeus* Morley, ibid. **4:** 207 (*non* Haliday 1838).
1911 *Exyston triangulatorius* Schmiedeknecht, *Opuscula Ichneumonologica*, **5:** 2300–2301.
1937 *Exyston pratorum* Hellén, *Notul. Ent.* **17:** 124.
1939 *Exyston phaeorrhaeus* Roman, *Ent. Tidskr.* **60:** 195 (*non* Haliday 1838).

Head slightly to moderately narrowed behind eyes and strongly rounded; rather shallowly to moderately emarginate behind: vertical region and temples very finely punctate, genae finely to moderately so; upper face finely to moderately and closely punctate, sometimes transrugulose just above antennae; epistoma rather coarsely punctate, sometimes reticulate in part. Clypeus for the most part rather coarsely punctate; sharply and rather deeply delimited basally; more or less weakly convex; often quite broadly rounded at apex. Malar space of female a little less than distance between mandibular apices; of male much shorter, about equal to width of annellus. Genal costa moderately raised, strongly but seldom angularly inflected (Fig. 48), often bearing short carinae in front: hypostomal costa strongly and roundedly raised, bent slightly outward. The gena is roundedly angulate between costa and mandibular base, in the position in which in other species there is an outer costa (see again Fig. 48): in male this angulation is carried farther back (dorsal), is much sharper near mandibular base, and bounds an intervening area that is more distinctly excavate behind articulation of mandible and is often distinctly though imperfectly transcarinate.

Antennae strongly hairy; with scape weakly excised externo-ventrally (Fig. 58); with postannellus generally less than 1·5 times length of following segment; with flagellum of female 23- to 26-, of male 22- to 25-segmented.

Pronotum with epomiae rather strong and sharp; laterally very finely punctate above, rugose in part below. Propleura finely punctate. Mesoscutum very strongly convex anteriorly, flattened discally; with notaulices shallowly impressed, but extending to beyond middle; more or less finely punctate, often with some faint rugulosity. Scutellum weakly to moderately convex; not margined to middle; generally finely punctate above, closely punctate or rugose-punctate behind, longitudinally rugose at sides. Mesopleura each with a large, almost impunctate area above; finely to moderately punctate below, moderately so above: sternaulices broad and moderately impressed: mesosternum very finely punctate: epicnemial carina moderately raised between and along fore margin of sternaulices, then bent upward on to mesopleura, medially almost completely interrupted: mesolcus moderately to strongly impressed, broadening posteriorly, closed behind. Propodeum with costae of moderate strength; mainly more or less finely rugose, but with some upper areae shining and very finely punctate, the area pleuralis generally discretely punctate in front, and the area posteromedia finely reticulate-rugose: area superomedia not distinctly delimited basally.



FIGS. 45–47. The very variable petiolar segment of *Exyston pratorum* Woldst. Fig. 45 drawn from a male from Orsa, middle Sweden, resembling the type and illustrating the applicability of Förster's diagnosis of *Tricamptus* to this species. Fig. 46 drawn from a normal female from Paanajärvi, NE. Finland, and Fig. 47 from a male from the New Forest in southern England, illustrating the other extreme condition.

Petiolar segment (Figs. 45–47) short for an *Exyston*, 1·3 to 1·7 times length of its greatest breadth; dorsally reticulate-rugose, sometimes finely so; not strongly auriculate basally; with dorsal keels broad and flattened at base, thereafter not very strong though sometimes almost percurrent: spiracular tubercles undeveloped or more or less prominent. Remainder of gaster moderately punctate, finely so towards apex; with tergites 2, generally to beyond middle, and 3 at base longitudinally finely rugose. Female third valvulae small, vomeriform.

Fore wings with basal and disco-cubital veins almost parallel; with areolet sessile or sub-sessile; with nervus parallelus emitted below middle of brachial cell. Hind wings with nervellus strongly antefurcal, intercepted below middle.

Tarsal claws finely pectinate.

Length 5 to 7½ mm.

Female. Head black, with the following parts ivory-white, usually in part suffused with flavous and margined with fulvous: palpi, mandibles except at apex, clypeus, genae broadly, and lower face largely. The pale colour on the gena usually extends beyond the angulation and on to the hypostomal costa; it extends broadly more than half-way up the sides of the lower face, which also bears a rather heart-shaped mark almost covering the epistoma: the pale marks on the lower face may be so largely confluent as to confine the lower black coloration to the tentorial pits. Antennae with basal segments mainly black, often castaneous at apex and sometimes more extensively below: beyond postannellus ferrugineous above, often paler towards base, dull fulvous below, often darker at apex. Thorax black, with the following parts pale-coloured as on head: propleura largely, tegulae, and scutellum and metascutellum at apex; usually lower angles of pronotum and often an extension along ventral margin, and generally a pair of marks on anterior margin of mesopleura; occasionally also marks on epicnemia, below bases of fore wings and down posterior margins of mesopleura. Fore and mid legs with coxae, trochanters and trochanterelli similarly pale-coloured, the trochanters dark-marked above, the coxae darkened usually only at base but sometimes more extensively; with femora fulvo-castaneous and with knees, tibiae, and tarsi fulvous to flavous: hind legs with coxae, trochanters, and trochanterelli black or almost so, pale at apex and on trochanterelli beneath; with femora, tibiae, and tarsi ferrugineous, the femora and tibiae more or less dull castaneous in middle or almost entirely, the tibiae sometimes much paler than the femora, and the knees conspicuously stramineous-white. Wing veins and stigma ferrugineous to fuscous, basally paler. Petiolar segment black. Remainder of gaster normally having tergite 2 black at base and sides, and 3 with isolated black marks at mid base and at anterior angles; with tergite 2 mainly rufocastaneous, the following similar but successively duller; with tergites having pale margins, yellowish to ivory, broader on successive segments to apex, covering most of tergite 6. In some specimens the black coloration is much more extensive, covering all of tergite 2 but the apical margin and thyridia; and in some the pale apical margins are much less pronounced.

Male differs as follows. Head without the pale marks on genae and sides of lower face, with heart-shaped mark on epistoma smaller, and with clypeus narrowly black along sutural margin. Thorax black; with tegulae generally pale; sometimes (as in type) with a transverse pale mark near apex of scutellum. Mid, and generally fore, coxae dark except at extreme apex. Gaster sometimes mainly black dorsally; pale margins of segments, on the average, narrower and sharper.

Redescribed from the following material: IRELAND, S. Tipperary, Ballinacourty, 1 ♀, W. Cork, Glengarriff, 1 ♀, Waterford, Dungarvan, 1 ♀, Queens Co., Portarlington, 1 ♂, Woodbrook, 1 ♀, N. of Emo Park, 2 ♀♀, Wicklow, Clara, 3 ♂♂ (one seen by A. Roman, see Roman, 1939), 1 ♀, Arklow dist., 1 ♂, Ballinclea, 1 ♂, Deputy's Pass, 1 ♀, Athdown, 2 ♀♀, 4.vi–26.vi and 26.vii–16.viii.1925–1945, A. W. Stelfox: SCOTLAND, Argyll, Puck's Glen, 1 ♂, 9.vi.1925, J. J. F. X. King; Inverness-shire, Aviemore, 1 ♂, 26.vi.1934, R. B. & J. E. Benson: ENGLAND, Devon, Cornworthy, 1 ♀, T. A. Marshall coll.; Kingsteignton, 2 ♂♂, 1 ♀, Hilber, 1 ♂, Lustleigh, 1 ♂, Newton Abbot, 1 ♂, 3–20.vi., 1933–1942, J. F. Perkins; Hants, New Forest, 1 ♂, 26.v.1912, G. T. Lyle, 2 ♀♀, 17–24.vi.1923, H. Scott; New Forest, Lyndhurst, 1 ♀, 18.vi.1907, C. Morley (see above, p. 370); Surrey, Oxshott, 1 ♂, 14.viii.1890, T. A. Marshall coll.; Abinger, 1 ♀, 28.viii.1947, G. J. K.; Herts., Brickett Wood, 4 ♂♂, 1 ♀, 26.v.–9.vi., 1936–1937, R. B. Benson; Lancs. mid, Carnforth, Leighton Moss, 1 ♀, 5.vi.1941, H. W. Miles; Westmorland, Foulshaw Moss, 1 ♂, 1 ♀, 8.vi.1941, G. J. K.: BELGIUM, unlocalized, 1 ♂, 4 ♀♀, C. Wesmael; Vivier d'Oie, 1 ♀, 18.v.1883, 1 ♀, 2.vi.1881, Orval, 1 ♀, 6.viii.1892, Stockel, 1 ♀, 13.viii.1890, J. Tosquinet: SWEDEN, Dalarne, Orsa, 1 ♂, 4.viii.1938, G. J. K.: FINLAND, Ladoga-Karelia, Sortavala, 1 ♂, 27.vi, Woldstedt (type); Kuusamo, Liikasenvaara, 1 ♀, 3.viii.1935, Paanajärvi, Ruskeakallio, 1 ♀, 17.vii.1935, G. J. K.: FRANCE, Paris district, Claman, 1 ♀, 5.vi.1892, Mesnil-le-Roi, 1 ♀, J. de Gaulle: SWITZERLAND, Buchholz, 1 ♀, 12.viii.1907, ? captor; Berisal, 1 ♀, vii.1909, J. de Gaulle; Valais, les Haudères, 1 ♂, 1 ♀, 6–27.vi.1935, Ferpècle, 1 ♂, 21–27.vi.1935, R. B. & J. E. Benson: GERMANY, Eisenberg, 1 ♀, Th. Kupka: CZECHOSLOVAKIA, Aussig, 1 ♂, 20.v.1935, 1 ♀, 19.vi.1932, Th. Kupka.

Further material seen: SWEDEN, material in Stockholm and Lund museums, including Thomson's type series: FRANCE, Mesnil-le-Roi, Maisons-Laffitte, Sèvres, J. de Gaulle, Vendresse, A. Seyrig, 8 specimens in Paris museum: GERMANY, Crefeld, 1 specimen, A. Ulbricht (Paris museum); Bodmann am Bodensee, 1 ♂, 26.v.1949, G. Heinrich; Helzen, 1 ♂, 17.v.1943, Stolzenau, 1 ♀, 3.vi.1945, Göttingen, 1 ♀, 13.ix.1949, R. Hinz: AUSTRIA, Styria, Admont district, 1 ♂, 1 ♀, 10.vi.1950, 1 ♀, 3.vii.1950, G. Heinrich.

The last-mentioned female specimen has the gena like that of the male, and has comparatively small yellow marks on the propleura.

This is a more than ordinarily variable species; yet, after examining all the above diverse material, I am satisfied that it does belong to a single species. The male specimen from Orsa, middle Sweden, has been presented to the British Museum collection: it agrees very well with the type, except that it has the petiolar segment more distinctly auriculate at base.

Fig. 45, of the petiolar segment, demonstrates that this species does not disagree with Förster's diagnosis of *Tricamptus*, so that Woldstedt's selection is valid whether the rules require agreement with the diagnosis or not. *Tricamptus* falls, therefore, as a synonym of *Exyston* Schiødte. This new synonymy has been published by Mason (1951, April: 230)

Time of appearance. Ulbricht (1926: 21) records that his dates of capture of this species were in May and the beginning of June, and then again in August. The dates of capture I have been able to record lead me to believe that there are two generations a year in most districts; for they range from 17.v to 3.vii and from 26.vii to 13.ix. The only exceptions are a single unspecified July date for a Swiss capture; and a mid-July date from NE. Finland, where the climate is such that one would expect a species normally having two generations a year to have only one.

Exyston 'triangulatorius Hlgr. var. *melanurus'* Ulbricht

Ulbricht's variety *melanurus* was based on a specimen or specimens he had captured, and which he attributed to the last of the three varieties brought forward by Schmiedeknecht (1911: 2301). He gave as description 'Hinterleibspitze schwarz gefleckt', within inverted commas; but this was not an exact quotation of Schmiedeknecht, whose words were 'Var. 3.♂. Die hinteren Segmente schwärzlich gefleckt.'

Moreover, the varieties presented by Schmiedeknecht were not always original, but may often be traced to an earlier author. These three varieties may be traced to Holmgren (1858: 235), whose actual relevant words were 'var. 3 ♂: abdomine nigro-notato'.

Through the kindness of Herr B. Maixner I have been able to see the Ulbricht material of *Exyston* in the Crefeld museum. All specimens standing under this species are correctly determined to species. Three stand under the species name, unqualified, and others under three varietal numbers. Two of these segregates may be considered to correspond with varieties mentioned by Schmiedeknecht, if numbers be transposed and the sexes reversed [actually Schmiedeknecht's var. 1 is the usual condition for the male, but I have never seen a female to correspond]. But the specimens under Ulbricht's remaining number, his var. 2, are not mutually consistent in colour pattern, not even approximately so. One of the specimens not arranged as a variety is labelled 'var. 2 Hlgr.' So I feel able to select as lectotype of *melanurus* Ulbricht another specimen not arranged as a variety. This is a small male specimen having a small blackish spot on tergite 6, to the right of the midline, and also correspondingly at extreme base of tergite 7. This mark is clearly individual and of no real varietal significance. The only other specimen that might have served is a male arranged under var. 2, having tergite 5 mainly infuscate above but not tergite 3. No doubt it was a specimen marked in some such way as that that Holmgren placed as his var. 3.

Key to Palaearctic Species of *Exyston* Schiødte

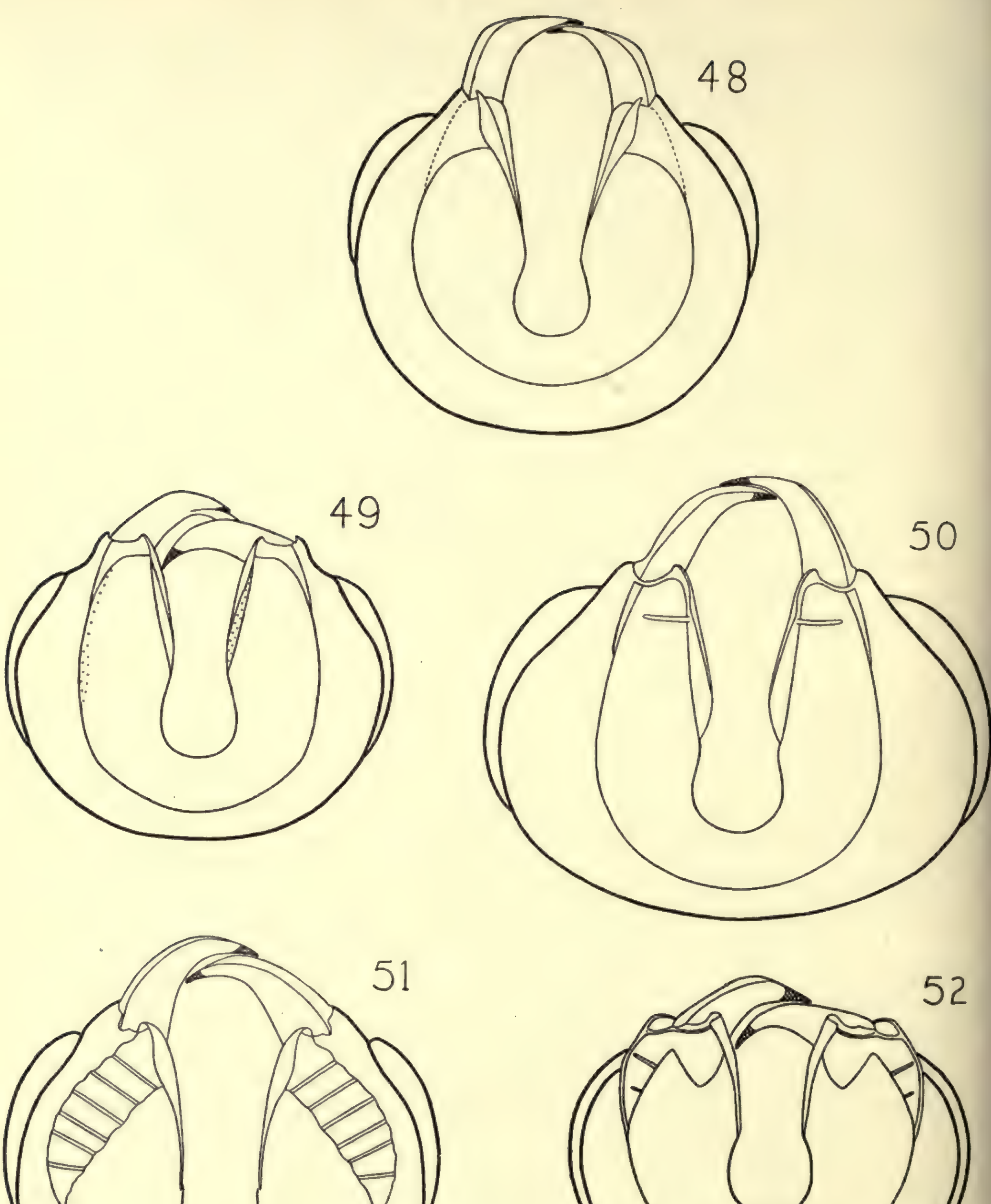
1. Genal costa single and not remote from mandibular base (Figs. 49, 50): female third valvulae not vomeriform: scape deeply excised externally (Fig. 53) . 2
Genal costa double, or single and remote from mandibular base: female third valvulae vomeriform: scape not deeply excised externally except in *phaeorrhaeus* Hal. (easily distinguished in facial view, Fig. 43) 3

2. Genal costa continuous or almost so (Fig. 50) . . . . *cinctulus* Grav.
Genal costa inflected, though not remote from mandibular base (Fig. 49) . . . . *cinctulus* Grav. ab. *approximatus* nov.

3. Genal costa double, the outer costa continuous or almost so, the inner costa inflected 4
Genal costa single and strongly inflected (e.g. Fig. 48) 6

4. Genal costae crenulate, rather regularly curved (Fig. 51), the intervening space traversed by a series of ridges: petiolar segment elongate and slender, at least 2·5 times length of its greatest breadth near apex: flagellum more than 30-segmented . . . . *genalis* Thoms.
Inner genal costa very strongly sinuate and pointed (e.g. Fig. 52): petiolar segment not 2·5 times length of its greatest breadth: flagellum less than 30-segmented 5

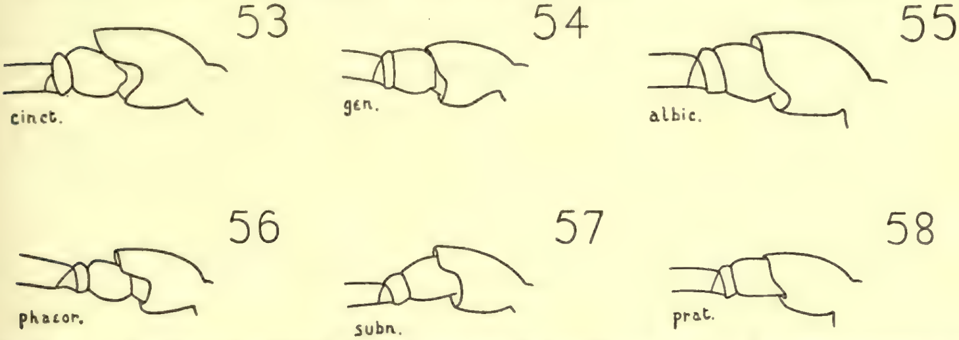
5. A very strongly hairy species, with gaster strongly clavate: gena (Figs. 43, 52) as in detailed description (p. 378): antennal scape strongly excised externally (Fig. 56): tergite 2 to beyond middle closely beset with moderate punctures and not shining: fore wings with basal and disco-cubital not extraordinarily strongly convergent . . . . *phaeorrhaeus* Hal.



FIGS. 48–52. Head in hind view of Fig. 48. *Exyston pratorum* Woldst. Fig. 49. *Exyston cinctulus* Grav. ab. *approximatus* nov. (lower tooth of right mandible malformed). Fig. 50. *Exyston cinctulus* Grav., normal. Fig. 51. *Exyston genalis* Thoms. Fig. 52. *Exyston phaeorrhaeus* Hal. Fig. 48 drawn freehand.

A much less strongly hairy species, with gaster scarcely clavate: gena (Fig. 44) differing as detailed in description (p. 380): antennal scape weakly excised externo-ventrally (Fig. 57): tergite 2 finely and rather sparsely punctate and shining: fore wings with basal and disco-cubital extraordinarily strongly convergent . . . . *subnitidus* Grav.

6. Clypeus very superficially delimited basally and not set distinctly at an angle with lower face: propodeum with areolation weak and incomplete in middle; in particular, the area superomedia is not or very indistinctly bordered basally and laterally: tergite 2 discretely punctate and shining . *albicinctus* Grav.



FIGS. 53–58. Left antennal scape, &c., in sinistro-lateral view, of Fig. 53. *Exyston cinctulus* Grav. Fig. 54. *Exyston genalis* Thoms. Fig. 55. *Exyston albicinctus* Grav. Fig. 56. *Exyston phaeorrhaeus* Hal. Fig. 57. *Exyston subnitidus* Grav. Fig. 58. *Exyston pratorum* Woldst.

Clypeus quite deeply and sharply delimited and set distinctly at an angle with lower face: propodeum with areolation normally complete and moderately strong: tergite 2 at least finely rugose in about basal half 7

7. A larger, more elongate species, with length of unique male 10 mm.: antennae normally hairy: pronotum laterally moderately punctate above and mesopleura coarsely punctate in front: petiolar segment about 2½ times length of its greatest breadth: fore wings with basal and disco-cubital strongly convergent: Kamtchatka, R. Malaise (*genalis* Roman 1931 *non* Thomson) . . . sp.

A moderate-sized species, not more than about 7 mm. in length: antennae very strongly hairy: pronotum laterally very finely punctate above and mesopleura no more than moderately punctate: petiolar segment about 1½ times length of its greatest breadth: fore wings with basal and disco-cubital almost parallel: a rather common European species . . . . *pratorum* Woldst.

ALTERNATIVE KEY TO EUROPEAN SPECIES OF *EXYSTON* SCHIØDTE

In the foregoing key a natural arrangement has been attempted, and the fullest use made of diagnostic characters. The following may serve for the readier separation of species known from Europe, especially where few specimens are available, and the hinder head and female valvulae cannot be clearly observed:

1. Antennal flagellum almost always more than 30-segmented 2

Antennal flagellum less than 29-segmented 4

2. Clypeus very superficially delimited basally: areolation of propodeum decidedly incomplete in middle: petiolar segment not 2·5 times length of its greatest breadth . . . . *albicinctus* Grav.

   Clypeus quite deeply and sharply delimited basally: areolation of propodeum normally complete: petiolar segment often more than 2·5 times length of its greatest breadth near apex (*e.g.* Pl. 5) 3

3. Antennal scape deeply excised externally (Fig. 53): hind trochanter dark- or dull-marked above; scutellum pale-marked at apex except in the darkest males . . . . *cinctulus* Grav.

   Antennal scape weakly excised externo-ventrally (Fig. 54): female hind trochanter usually, and male scutellum immaculate . . . . *genalis* Thoms.

4. Antennal scape strongly excised externally: gena strongly angularly raised, bulging outward as seen in facial view in Fig. 43: gaster strongly clavate . . . . *phaeorrhaeus* Hal.

   Antennal scape not strongly excised: gena not thus raised: gaster not strongly clavate 5

5. Antennae normally hairy: tergite 2 sparsely and finely punctate, not rugose: fore wings with basal and disco-cubital extraordinarily strongly convergent: hind tibiae not whitish at base . . . . *subnitidus* Grav.

   Antennae very strongly hairy: tergite 2 finely longitudinally rugose to beyond middle: fore wings with basal and disco-cubital almost parallel: hind tibiae conspicuously stramineous-white at base. . . . *pratorum* Woldst.

Genus *PAREXYSTON*, gen. n.

Genotype *Exyston calcaratus* Thoms. (monobasic).

Reference to this new genus is made in the discussion of genera (pp. 313–314), and the characters are defined in the key to genera (pp. 316–319). The single described species has previously been placed in *Exyston*; but I think it is more closely related to *Smicroplectrus*, and particularly to *S. clémenti* sp.n. (p. 404).

Parexyston calcaratus Thomson

When studying the series in the Thomson collection in 1938 I noted the following characters additional to those given by Thomson (1883): head shining; narrowed behind eyes but not much rounded; very broadly emarginate behind. Cheeks very long. Hypostomal and genal costae strongly elevated: the genal costa is not double, but the cheek is angulate therefrom to the lower articulation of the mandible. Antennae incrassate almost to apex, with apical segment pointed. Thorax shining: epomiae very long and strong: notaulices very strong: scutellum margined to beyond middle, but not sharply: epicnemial carina strongly raised: sternaulices broad: mesolcus deeply impressed, open behind. Propodeum dorsally rugose, shining on area pleuralis; with costae strong: area superomedia sub-hexagonal, emitting costulae in middle: area petiolaris extending to middle. Petiolar segment rugose; with basal lobes; with dorsal keels not strong but almost percurrent. Tergite 2 with sculpture basally rugose, apically finer; thyridia large, about half breadth of space between them. Remaining tergites shining.

Description from 2 ♀♀, 4 ♂♂ in Thomson collection.

Since that date, the following material has been examined: IRELAND, Co. Wicklow, Monagloch, 1 ♀, 8.vi.1926, A. W. Stelfox: ENGLAND, Devon, Kingsteignton, Starks Ponds, 1 ♂, 2 ♀♀, 29.v–1.vi.1942, Highweek, 1 ♂, 1 ♀, 22.v.1942, Newton Abbot, 1 ♂, vi.1940, J. F. Perkins; Notts., Teversall, 1 ♀, 26.vi.1913, J. W. Carr (recorded as *brevipetiolatus* Thoms.); Suffolk, Monks Soham, flying at blackthorn, 2 ♀♀, 23.v.1920, C. Morley (recorded as *subnitidum* Grav.): HOLLAND, Oisterwijk, 1 ♀, 18.vi.1943, H. G. M. Teunissen: SWEDEN, Skåne, Höör district, 1 ♂, 28.vi.1938, D. M. S. & J. F. Perkins: FINLAND, Keuru, 1 ♀, W. Hellén (recorded as *pratorum* ab. *nigriceps* Hellén); Hattula, 1 ♂, L. v. Essen: GERMANY, Berlin district, 1 ♀, Ruthe coll.

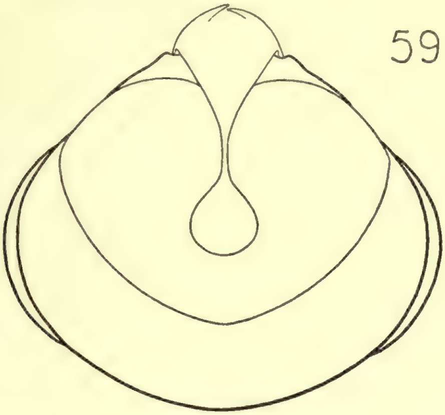


FIG. 59. Head in hind view of *Parexyston calcaratus* Thoms.

Of the above, the Ruthe collection specimen is 6½ mm. in length, and has the thorax and propodeum largely rufous, as in the syntypes. With one exception, the remaining specimens are of a much smaller form, 4 to 4½ mm. in length, and have the ground colour of the thorax and propodeum black or blackish. This form looks so distinct that I would have thought it merited varietal status; but the specimen from Holland is an intermediate, having a length of 5½ mm. and the thorax notably paler than in this form. The large rufous and the small dark forms are not or not widely geographically separated, for both have been taken in the southern Swedish province of Skåne.

The second segment of the maxillary palps is strongly swollen in this species.

The earlier British record of this species (Carr, 1924: 53) was based on three specimens of *Smicroplectrus quinquecinctus* Grav.

Genus *SMICROPLECTRUS* Thomson

1883 *Smicroplectrus* Thomson, *Opuscula Entomologica*, fasc. 9: 881–882, 888.

If our knowledge of the genus *Exyston* in Europe has been in an unsatisfactory condition, our knowledge of European *Smicroplectrus* has been quite rudimentary.

Though there are other good characters available for the separation of some of the species, it is the form of the hinder gena that is of prime importance, and this has never before been properly studied. Roman (1913: 128), from the study of a single female specimen in the Stockholm museum, discovered that in *S. quinquecinctus* Grav. there is a double genal costa, the inner costa being sharply raised and inflected: in all other forms known to him he found no outer costa. He failed to observe the difference in the form of the gena of *jucundus* Hlgr. from that in *bohemani* Hlgr., and considered that there was no more than one species described under *bohemani, jucundus,* and *costulatus.*

After prolonged study, I recognize eight European species; and of these, only one remains a unique type, and this one is very distinct. All seven others are represented in my material by series of over twenty specimens. It is hoped that this revision will provide a sound basis for the study of at least the European species: I now find I can place well over 90 per cent. of the specimens confronting me. Doubt of the identity of some of the males, especially smaller ones, is no cause for wonder; but it is vexing as well as perplexing to be still unable to place four female specimens. One of these specimens, however, looks like an intermediate between two of the recognized species. Since *Smicroplectrus* species are, so far as is known, almost all attached to Nematine sawflies on catkin-bearing plants, predominantly *Salix,* it seems quite possible that hybridization would sometimes occur.

The difficulty of discriminating the species was greatly increased by the existence of small, pale forms, which I recognize in five species, of which the majority of specimens are larger and darker. These forms are of smaller size and have fewer antennal segments than normal individuals: the general darker body colour is altogether paler, though the pale colour may be brighter; the punctation is weaker, though the grosser sculpture may be more outstanding. Whether these differences are due to the use of different hosts, to nutritional differences in individuals, or to rate of development at a particular time of year is not known. They do, however, intergrade with the normal, and cannot even be regarded as distinct varieties.

Apart from these small, pale forms, which do not seem previously to have been noted, the European species are very uniform in general colour pattern. Thus it has happened that species have not been described on concomitant colour characters, as happened in most Ichneumonid genera, and several are now new. For the eight European species recognized, only five names are available; and I place two of these as synonyms, having examined all the types concerned. The colour characters that have been used, such as the colour of the hind coxae, and the presence or absence of a pale apical mark on the scutellum, are found to break down; and are unlikely to do more than provide negative evidence in some cases and within defined regions. The degree of development of the costula is quite unreliable for separating the species.

The type species, *S. quinquecinctus* Grav., is also regarded as the typical species, and others are to a large extent described in comparison with it.

Tryphon incisus Grav. was placed in *Exenterus* by Pfankuch (1906), but transferred to this genus by Schmiedeknecht (1911) on account of the mention of a relatively long hind tibial spur. I have seen the single female specimen in the Gravenhorst collection, and can state that the hind tibial spur is about two-fifths the length of the metatarsus, and that the mid tibia bears two spurs. The species can, therefore, be excluded not only from this genus but from the tribe Ctenisicini. I did not, at the time, identify it positively; but, from my recollection of it, I suppose it to belong to the Polyblastina.

Smicroplectrus quinquecinctus Gravenhorst

1820 *Ichneumon quinquecinctus* Gravenhorst, *Mem. Accad. Sci. Torino*, **24**: 374.
1829 *Tryphon quinquecinctus* Gravenhorst, *Ichneumonologia Europaea*, **2**: 165–166.
1858 *Exenterus erosus* Holmgren, *Svensk Vet.-Akad. Handl.* **1**: 227.
1906 *Smicroplectrus quinquecinctus* Pfankuch, *Z. Hym. Dipt.* **6**: 94.

Head (Figs. 63, 64) not strongly transverse; moderately, sometimes rather strongly, narrowed behind eyes in female and strongly so in male, slightly rounded; moderately emarginate behind: with vertical region and orbits finely and sparsely punctate; before occiput and on temples and cheeks moderately so; cheeks below and upper face much more coarsely and densely punctate, and epistoma still more coarsely and densely so, bearing punctures separated by much less than their own diameters: sometimes the sculpture is rugose on mid line above and below antennal bases. Clypeus sparsely and rather finely punctate below, more coarsely and densely so above; rather deeply delimited, with tentorial pits conspicuous; not strongly convex basally, and rather shallowly impressed before the narrowly rounded apex. Malar space longer than distance between mandibular apices in female, about as long in male. Genal costa strongly laminately elevated, not or scarcely angularly inflected: gena with an outer costa elevated at least part way back from mandibular base, thence completed as an angulation running to genal costa. Hypostomal costa strongly raised, evenly rounded below junction of genal costa. Genal pit enclosed by these costae distinctly broader along genal costa than its length along hypostomal (Fig. 69).

Antennae with scape (Fig. 60) weakly excised externo-ventrally: flagellum 26- to 32-segmented, moderately explanate in middle.

Pronotum with dorsal transverse furrow shining; with epomiae sharp and of moderate strength; laterally strongly punctate above, finely rugulose-punctate below. Propleura strongly punctate. Mesoscutum strongly convex anteriorly; with notaulices strongly impressed anteriorly, running far beyond middle and falling into a median depression; rather finely to moderately punctate, much more densely so anteriorly between notaulices. Scutellum strongly convex; finely and sparsely punctate above, more coarsely and densely so at sides and behind; margined usually to about middle but sometimes well beyond; more or less longitudinally impressed on disk. Mesopleura rather coarsely to coarsely punctate, rather closely below, more moderately so above, and with a shining speculum: sternaulices broad, rather shallowly impressed: mesosternum finely and densely punctate, prepectus strongly so: epicnemial carina dorsally incomplete, distinctly elevated in female and slightly so in male: mesolcus narrow but deeply impressed, a little broadened posteriorly, closed behind. Propodeum with costae moderately strong, sometimes strong; with dentiparal areae weakly produced and with costulae complete or incomplete; finely rugose to rugose-punctate, with the area pleuralis moderately and discretely punctate, and the area posteromedia more or less rugose, generally transversely so: area basalis not delimited apically: area superomedia more or less explanate to near apex, moderately rounded behind.

Gaster on tergites 1 and 2 mainly, and 3 at least at base, coriaceo-rugose; elsewhere mainly alutaceo-punctate, generally strongly so, giving the surface a decidedly matt appearance; with the hinder segments smoother and more shining towards apex. Petiolar segment (Fig. 74) 1·4 to 1·8, often less than 1·6 times length of its greatest breadth; strongly margined, with basal lobes pointed, sometimes acutely so; with dorsal keels rather strong and almost percurrent. Tergite 2 with diagonal basal impressions fairly distinct but ill-defined.

Fore wings with stigma and radial cell of normal, rather elongate shape: stigma about 4·0 times (varying 3·6 to 4·3), radial cell about 2·8 times as long as broad; with basal and disco-cubital veins nearly parallel; with areolet rather small and sub-sessile or shortly petiolate; with nervus parallelus emitted in middle of branchial cell. Hind wings with nervellus opposite or slightly antefurcal and intercepted about in middle, or a little below.

Legs of normal, slender form: hind metatarsus about 7 times length of its greatest breadth in inner side view in female, 6 to 7 times in male. Tarsal claws moderately, sometimes weakly pectinate.

Length of normal form 7 to 12 mm.

Female. Head black, with the following parts ivory-white, often in large part pale flavous, sometimes merging to fulvous, particularly on palpi: clypeus, genae, lower face, except narrowly below and between antennae, and mouth-parts except mandibular apices. Antennae dark above, below with scape pale flavous, and the segments that follow pale flavous, merging to fulvous in apical half of antenna. Thorax and propodeum black, with the following parts pale-coloured as on head: anterior margin at sides and humeral angle of pronotum, propleura, tegulae, laminate margins of mesoscutum behind tegulae, wide margin of prepectus, sometimes a pair of marks beside mesolcus, line below fore wings, mesepimera, scutellum at apex and metascutellum and their lateral extensions, and piliferous lobes of metanotum. The scutellum is often more or less dull fulvous discally, and the propodeum may be dull fulvous marked. Legs mainly fulvous to rufous; with fore and mid coxae and trochanters and fore femora anteriorly flavous, merging to fulvous: apical segment of mid tarsus and hind femora at apex infuscate: hind tibiae and tarsi almost black, sometimes paler below: hind coxae and trochanters occasionally darkened. Wings slightly infumate, with veins and stigma fuscous to ferrugineous, basally pale. Gaster black: tergite 1 sometimes with a median apical spot, and following tergites more and more broadly margined apically and laterally with ivory-white, the margins often bordered anteriorly with pale fulvous: the white colouring covers more than half the exposed surfaces of tergites 6 and 7.

Male. Differs from the female as follows: genae more narrowly pale, usually black between outer and inner costae; lower face occasionally black in mid line. Propleura generally quite black, occasionally pale near mid line and behind: pale margins of pronotum and prepectus absent or reduced to mere dots. Hind coxae and trochanters usually in greater part black: fore and mid coxae sometimes dark-marked (especially in British specimens). Pale margins of tergites becoming broader towards apex of gaster much more gradually; the white colouring usually covering less than half the exposed surfaces of tergites 6 and 7.

This species is illustrated on Pl. 6.

Redescribed from the following material: SCOTLAND, Inverness-shire W., Arisaig, 1 ♂, 9.vii.1939, A. W. Stelfox: ENGLAND, Dorset, Studland, South Haven Peninsula, 12-acre Wood, 1 ♀, 22.vi.1934, G. J. K. (compared with Gravenhorst material and with type of *erosus* Hlgr.); Surrey, Chobham, 1 ♀, 16.v.1891, Melville-Bury coll.; Essex, Colchester, 3 ♂♂, 1914; Suffolk, Sudbury, 1 ♂, 1921, W. B. or B. S. Harwood; Bucks., Princes Risborough, 1 ♀, 21.vi–4.vii.1942, Brickhill, 1 ♂, 21.vi.1937, Herts., Brickett Wood, 1 ♂, 9.vi.1936, R. B. Benson; Staffs., Lichfield district, 2 ♂♂, 1 ♀, 1923, L. A. Carr (one recorded as *Exyston calcaratus* Thoms.); Yorks., Ayton Wood, 1 ♀, 10.vii.1921, F. Pepper: BELGIUM, unlocalized, 1 ♀, C. Wesmael; Groenendaele, 1 ♀, 27.vi.1880; Ormeignies, 1 ♀, 29.viii.1880; Hestreux, 2 ♀♀, 6.viii.1884; Rhode St. Genèse, 1 ♂, 27.vi.1884; Vivier d'Oie, 1 ♀, 19.viii.1888; Espinette, 1 ♂, 26.v.1890; Verrewinkel, 1 ♂, 4.vi.1891, J. Tosquinet: HOLLAND, Venlo, 1 ♀, 21.vi, 1 ♂, 24.viii, 1 ♀, 29.viii.1942; Meiendel, 1 ♀, 13.vii.1939, 1 ♂, 1 ♀, 6.vi.1940; Schayk, 1 ♀, 19.vi.1948, H. G. M. Teunissen: SWEDEN, Skåne, Höör district, 1 ♂, 13.vii; Röstånga, 1 ♀, 5.vii, Degaberga, 1 ♀, 10.vii.1938, D. M. S. & J. F. Perkins; Småland, 1 ♀, C. Boheman (type of *erosus* Hlgr.): FINLAND, Lojo, 1 ♀, R. Krogerus; 1 ♀, 17.viii.1918, Håkan Lindberg: FRANCE, Sèvres, 1 ♀, 3.vi.1895, J. de Gaulle: SWITZERLAND, Nyon, 1 ♀, Cheyr: GERMANY, Göttingen, 1 ♀, 29.vi.1948, Helzen, 1 ♀, 26.v.1943, 1 ♂, 28.v.1945, R. Hinz; Bavaria, Bodmann am Bodensee, 1 ♀, 19.vi.1949, Bayrische Wald, Waldmünchen, 800 m., 1 ♀, 16.vi.1948, G. Heinrich; Görkau, 1 ♀, vii.1930, Th. Kupka: CZECHOSLOVAKIA, Bohumin, 1 ♀, 14.vii.1938, Th. Kupka; Chodau, 1 ♀, 27.vii.1886, R. von Stein: RUSSIA, Orel, 1 ♀, 22.vi, 1 ♂, 26.vi.1943, R. Hinz.

Further material seen: FRANCE, Maisons Laffitte, 3 specimens, J. de Gaulle.

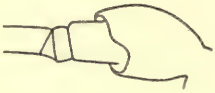
The small, pale form of this species has the costae of the propodeum and petiolar segment very strongly developed, but the punctation in parts relatively poorly so. Apart from the paler colour, especially of legs and gaster, it agrees with the description of the species given above. Antennal flagellum 26- to 27-segmented: length 6½ to 7 mm. Described from the following: BELGIUM, 1 ♂, 1 ♀, C. Wesmael: GERMANY ?, 1 ♀, O. Schmiedeknecht: SWEDEN, Skåne, Kivik, 1 ♀, 19.vii.1938, D. M. S. & J. F. Perkins.

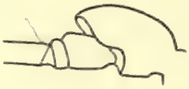
The Irish record of this species (W. F. Johnson, 1915: 132) is based on a male of *Acrotomus succinctus* Grav.

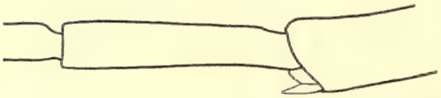
I do not think it will be possible to determine, from Gravenhorst's description of 1820, which species of *Smicroplectrus* he then had before him. Since the original material is not to be found in the Spinola collection in Turin (see Kerrich, 1950), we must accept the monograph of 1829 as the first revision. The England, Dorset, specimen was compared by me with the specimens in Breslau in 1938, and was found to be the same species. In 1947 I compared it with the type of *erosus* Hlgr. and thus confirmed the synonymy suggested by Pfankuch (1906).

Smicroplectrus excisus sp. n.

Head (Fig. 65) not strongly transverse; sharply and, in type form, almost rectilinearly narrowed behind eyes; shallowly emarginate behind: finely to moderately punctate, seemingly on the average more finely so in male; cheeks below, lower face and upper face densely and rather coarsely punctate, occasionally rugose-punctate. Clypeus more sparsely punctate and usually apically less narrowly rounded than in *quinquecinctus* Grav., the punctures fine to moderate; rather deeply delimited, with tentorial pits conspicuous; in type form not strongly convex basally, and rather shallowly impressed before apex. Malar space about equal to distance between mandibular apices in female, distinctly less in male. Genal costa laminately elevated, though less strongly than in *quinquecinctus* Grav., angularly inflected: gena with outer costa and genal pit as described for *quinquecinctus*. Hypostomal costa strongly raised, obtusely round-pointed below junction of genal costa.


60


61


62

Figs. 60–61. Left antennal scape, in sinistro-lateral view, of Fig. 60. *Smicroplectrus quinquecinctus* Grav. Fig. 61. *Smicroplectrus excisus* sp.n. Fig. 62. Left hind metatarsus in inner side view of *Smicroplectrus excisus* sp. n.

Antennae with scape (Fig. 61) strongly convex above and very deeply excised externo-ventrally: flagellum normally 25- to 30-segmented, moderately explanate in middle.

Pronotum with dorsal transverse shining impression narrow, rather indeterminate; with epomiae rather strong; laterally rather strongly punctate above, more finely rugulose-punctate below. Propleura moderately to rather coarsely but shallowly punctate. Mesoscutum in type form weakly convex anteriorly, but often rather strongly so; with notaulices broad but not deeply impressed anteriorly, running far beyond middle and falling into a median depression; moderately and sparsely punctate, rather more finely and densely so anteriorly. Scutellum strongly convex, normally not margined to middle; moderately and usually sparsely punctate discally, much more densely punctate to rugose-punctate peripherally; slightly impressed on disk. Mesopleura rather coarsely punctate, with a shining speculum: sternaulices broad, moderately impressed: mesosternum finely and densely punctate, more sparsely so behind: prepectus coarsely alutaceo-punctate, deeply excavate: epicnemial carina moderately elevated: mesolcus broad, moderately to deeply impressed, almost always transcostate, closed by a strong costa behind. Propodeum with costae rather strong; with costulae complete; finely punctate to rugose, with area pleuralis discretely punctate except below; with area posteromedia much more strongly rugose: area basalis delimited apically: area superomedia usually almost regularly hexagonal, emitting costulae about in middle, but sometimes much more strongly narrowed to base and with costulae well behind middle.

Gaster on tergites 1 mainly, and 2 and 3 at base, coriaceo-rugose, but petiolar segment sometimes almost smooth between the dorsal keels; elsewhere usually finely and rather sparsely punctate and strongly shining. Petiolar segment normally 1·3 to 1·6 times length of its greatest breadth; moderately strongly margined; with basal lobes pointed, sometimes acutely so; with dorsal keels of moderate strength to strong, almost percurrent. Tergite 2 with diagonal basal impressions usually distinct and rather strong, but ill-defined.

Wings as described for *quinquecinctus* Grav., but stigma and radial cell on the average about 10 per cent. relatively broader.

Legs relatively stouter than in *quinquecinctus* Grav., notably the hind tibiae and tarsi: hind metatarsus about 5½ times length of its greatest breadth in inner side view (Fig. 62). Tarsal claws moderately pectinate.

Length 5½ to 10 mm.

Differs little in coloration from *quinquecinctus* Grav. The scape and pedicellus below have the pale coloration generally duller and more restricted. The lower face is often more broadly black below the antennae and more distinctly on the mid line above, and the clypeo-frontal suture is dark: by contrast the propleura are pale-marked. In female, the pale marks of pronotum are less conspicuous, and the propleura are to some extent dark at sides: in male the pale margin of prepectus is often well developed, though narrower than in female. Coloration of legs similar in female: in male the hind coxae and trochanters are mainly fulvous. The pale margins of the tergites are less extensive. Wings similar.

Described from the following material: BELGIUM, unlocalized, 1 ♂, 1 ♀, coll. Wesmael; unlocalized, 1 ♂, 12.vii.1881, Hestreux, 3 ♀♀, 5–6.viii.1884, Orval, 1 ♀, 7.viii. 1892, J. Tosquinet: HOLLAND, Voorburg, on *Salix*, 1 ♀, 5.viii.1939, Biesbosch, 1 ♀, 23.vi.1943, H. G. M. Teunissen: SWEDEN, Skåne, Pålsjö, 2 ♂♂, 4 ♀♀, coll. C. G. Thomson; Röstånga, 2 ♀♀ (one the holotype), 1 ♂ (allotype), 4.vii.1938, Höör district, 2 ♂♂, 26–28.vi.1938, D. M. S. & J. F. Perkins; province Halland, 3 ♂♂, 23–27.vi, 1907–1911 (mus. Stockholm): FRANCE, ?France, 1 ♂ (under *Ct. sexcinctus* Grav.), J. de Gaulle; Ardennes, Verdun, 1 ♀, 10.viii.1925, Benoist: SWITZERLAND, unlocalized, 1 ♂, D. Imhoff (mus. Turin): GERMANY, Upper Bavaria, Haag-an-der-Amper, 1 ♂, v.1948, G. Heinrich; Celle, 1 ♀, 4.vii.1942, Göttingen, 1 ♂, 7.viii.1946, R. Hinz; 2 ♀♀, probably Berlin district, Ruthe coll.; Warnemünde, 1 ♀, viii.1886, S. Brauns (Nat. Mus. Ireland); unlocalized, 1 ♀, O. Schmiedeknecht (mus. Genoa): POLAND, Pomorzia, Sepolno, 2 ♂♂, 23–24.vi.1936, G. Heinrich: RUSSIA, Orel, 2 ♂♂, 26.vi.1943, R. Hinz.

Small pale form: GERMANY, 1 ♂, 8.ix.1854, Ruthe coll.; Warnemünde, 1 ♀, viii.1886, S. Brauns.

Holotype in British Museum (Natural History).

This species is variable in a number of respects. In the type form the head is almost rectilinearly narrowed behind the eyes (Fig. 65), the clypeus is not strongly convex basally, the mesoscutum is weakly convex anteriorly, and the scutellum is not strongly margined: in other specimens the head is decidedly rounded behind the eyes, the clypeus is much more strongly convex basally, the mesoscutum is rather strongly convex anteriorly, the scutellum is more strongly margined, and the body colour is rather paler. In the small pale form the body colour is altogether paler, the gaster is mainly ferrugineous, and the hind tibiae and tarsi are ochreous to ferrugineous: the flagellum is 23- to 26-segmented, and the length is 4½ to 5½ mm. Such differences might be due to the use of different host species, or to the nutrition of the individual hosts. The Thomson collection contains a series of five females and five males, all from Pålsjö: 1 ♀, 3 ♂♂ are of the small, pale form; and both other forms are included but are not sharply separable. All agree in the peculiar conformation of the scape and the gena, and in the possession of relatively short and thick hind legs: these characters distinguish the species most readily from its nearest known relative *quinquecinctus* Grav.

This species was identified by C. G. Thomson and Brauns as *erosus* Hlgr. but, as shown above, the synonymy of *erosus* Hlgr. with *quinquecinctus* Grav. has now been confirmed.

Smicroplectrus trianguligena sp. n.

Head not strongly transverse; moderately to rather strongly narrowed behind eyes in female, rather strongly to strongly so in male, less rounded than in *quinquecinctus* Grav.; rather shallowly emarginate behind: on vertical region and temples finely or rather finely punctate, and on genae and orbits of lower face moderately so; on epistoma rather coarsely punctate, sometimes in part confluently so: upper face rather finely to moderately and densely punctate, often transversely rugose-punctate above antennal sockets. Clypeus as described for *quinquecinctus* Grav. Malar space about equal to distance between mandibular apices in female, a little less in male. Genal costa moderately raised, a little less so than in *bohemani* Hlgr., more or less angularly inflected: hypostomal costa much as described for *quinquecinctus* Grav. Gena (Fig. 70) sharply angulate in position of outer costa, the angulation sometimes a little raised near mandibular articulation: the enclosed genal pit usually longer, along hypostomal costa, than its breadth along genal, and often traversed by one or two weak costae.

Antennae much as described for *quinquecinctus* Grav.: flagellum 28- to 33-segmented.

Thorax and propodeum structure differing from that described for *quinquecinctus* Grav. as follows: propleura moderately alutaceo-punctate: mesoscutum more evenly convex: epicnemial carina less elevated and sternaulices very superficial: propodeum with costae generally strong; with area superomedia sometimes weakly delimited basally: area pleuralis with punctation weak or rather weak.

Gaster with tergites 1 and 2 mainly, and 3 at base, coriaceo-rugose; elsewhere shining, more and more finely punctate towards apex: otherwise as described for *quinquecinctus* Grav., but petiolar segment on the average a little longer, 1·6 to 1·9 times length of its greatest breadth.

Wings as described for *quinquecinctus* Grav., but areolet usually longer petiolate.

Legs slender as in *quinquecinctus* Grav.: tarsal claws rather weakly pectinate.

Length 7½ to 11 mm.

Coloration very much as described for *quinquecinctus* Grav., but male propleura regularly pale-marked near mid line, and sometimes more extensively so. Male hind coxae not darkened in any but the Irish specimens. Pale margins of tergites sometimes less extensive.

Described from the following material: ENGLAND, Staffs., Lichfield dist., 1 ♂, 1921, L. A. Carr (recorded as *jucundus* Hlgr., Carr, 1924: 53): BELGIUM, unlocalized, 2 ♂♂, 1 ♀, C. Wesmael; Vivier d'Oie, 1 ♂, 29.v.1891, 1 ♀, 17.vii.1898 (?), J. Tosquinet: HOLLAND, Meiendel, 1 ♂, 2.vi.1937, H. G. M. Teunissen: FRANCE, Maisons-Laffitte, 1 ♂ (no date), St. Cloud, 2 ♂♂, 11–12.v.1887, Vincenne, 1 ♂, 30.iv.1890, Mendon, 1 ♀, 23.vi.1891, Mesnil, 1 ♀, 20.v.1892, Forêt de St. Germain, 1 ♂, 5.v.1894, Fontainebleau, 1 ♀, 17.vi.1898, J. de Gaulle; Nantes, 2 ♀♀, T. A. Marshall; Mayenne, la Sanbee, 1 ♀, 24.v.1926, Coulans, 1 ♀, 24.v.1926, Benoist; Yonne, Mezilles, 1 ♀, v.1940, 1 ♀, vi.1946, E. Cavro; 'St. Dii.N.' (? France), 2 ♂♂, 15.v.1921, Haut-Rhin, Bollwiller, 2 ♀♀, 30.v.1920 (one of the type), Roderv, 1 ♂, 12.vi.1932, A. Seyrig: SWITZERLAND, Nyon, 1 ♀, Cheyr; Peney, 1 ♂, 1886, Tournier: GERMANY, Rhineland, Geisenheim Notgottes, Forsthaus Rüdesheim, 1 ♂, 13.v.1923, E. Schmidt; Göttingen, 1 ♂, 10.v.1947, R. Hinz; Bodmann am Bodensee, 1 ♀, 17.v.1949, G. Heinrich: CZECHOSLOVAKIA, Erzgebirge, Aussig, 1 ♂, 26.v.1935, Th. Kupka: POLAND, Wlodzimierz, 1 ♀, 17.vi.1944, R. Hinz: EUROPE, 1 ♀ (no interpretable data).

Type ♀ in Muséum d'Histoire Naturelle, Paris.

This species comes between *quinquecinctus* Grav. and *bohemani* Hlgr.; and small specimens, especially males, may be difficult to separate from both. It does, however, differ from both in having the greater part of the gaster not alutaceo-punctate but strongly shining. The male hind coxae are not darkened in any but the doubtfully associated Irish specimens mentioned below, whereas those of *quinquecinctus* are considerably darkened in all western European material seen.

Provisionally I place here four small male specimens having the following data: IRELAND, Co. Wicklow, Powerscourt, 2 ♂♂ em. 4–11.v.1932, *ex* sawfly larvae, G. C. Scott; George's Bridge, 1 ♂, 19.v.1940, Co. Dublin, Glenasmole, 1 ♂, 21.v.1939, A. W. Stelfox. Length of these specimens 6 to 8 mm.: flagellum 23- to 27-segmented. In correlation with the small size, however, the characters are weakly developed; and confirmation of the occurrence of this species in Ireland by the capture of the female is much to be desired. Mr. Stelfox has kindly presented one of the Powerscourt specimens to the British Museum (Natural History).

Confirmation of the single English record would also be very acceptable.

Smicroplectrus bohemani Holmgren

1858 *Exenterus Bohemani* Holmgren, *Svensk Vet.-Akad. Handl.* **1:** 226–227.
1911 *Microplectron Bohemani* Schmiedeknecht, *Opuscula Ichneumonologica*, **5:** 2310, 2311.
1913 *Smicroplectrus Bohemani* Roman (*pars*), *Ent. Tidskr.* **34:** 128.

Head not strongly transverse; slightly to moderately narrowed behind eyes in female and moderately to rather strongly so in male, rather strongly rounded posteriorly; shallowly emarginate behind: on vertical region and temples rather finely and sparsely punctate, more densely so before occiput: genae rather coarsely and more or less densely, upper face densely and rather coarsely, and epistoma coarsely punctate; upper face and epistoma usually alutaceous and more or less confluently punctate. Clypeus coarsely and rather densely punctate above, sparsely and much more finely so below; deeply delimited; usually moderately convex basally and rather shallowly impressed before apex, which generally is narrowly rounded. Malar space about equal to distance between mandibular apices. Genal costa distinctly but not strongly laminately elevated, not angularly inflected, meeting hypostomal costa a moderate distance behind mandibular base, about as in *quinquecinctus* Grav. (Fig. 69): gena with no outer costa, but strongly rounded in that position. Hypostomal costa less strongly elevated than in *quinquecinctus* Grav., rounded or very obtusely pointed below junction of genal costa.

Antennae with scape rather weakly or moderately excised externo-ventrally: flagellum 26- to 32-segmented.

Pronotum with dorsal transverse shining impression narrow, deeply impressed; with epomiae strong and sharp; laterally rather coarsely and very densely punctate above, merging to alutaceo-punctate below. Propleura densely and rather coarsely punctate. Mesoscutum normally convex anteriorly; with notaulices deeply impressed and often transcostate anteriorly, running far beyond middle and falling into a median depression; finely to moderately punctate, more finely and densely so anteriorly between notaulices. Scutellum moderately convex; usually rather strongly punctate above, densely so behind; slightly impressed on disk. Mesopleura coarsely and more or less densely punctate, less coarsely so above, and with a shining speculum: sternaulices superficial: mesosternum rather finely and densely punctate, more sparsely so posteriorly: prepectus coarsely and very densely punctate: epicnemial carina weakly elevated: mesolcus narrow anteriorly, broadened posteriorly, moderately impressed, incompletely closed behind. Propodeum generally with costae strong and costulae complete; with dentiparal areae often rather strongly produced; finely to moderately rugose, with the area posteromedia usually strongly so, and the area pleuralis for the most part discretely punctate: area basalis not delimited apically: area superomedia rather shining and often somewhat excavate.

Gaster as described for *quinquecinctus* Grav., but usually less strongly alutaceo-punctate and with diagonal basal impressions indistinct: petiolar segment 1·3 to 1·7 times length of its greatest breadth.

Fore wings as described for *quinquecinctus* Grav.; but hind wings with nervellus often intercepted well below middle.

Legs slender as in *quinquecinctus* Grav.: tarsal claws weakly to moderately pectinate.

Length of normal form 7 to 12½ mm.

Coloration very much as described for *quinquecinctus* Grav., but the ivory-white usually purer, with much less flavous. Lower face of female sometimes black more than half-way down in mid line; of male sometimes black except for inner orbits and a pair of pale marks on epistoma: male genae only narrowly pale. Trochanterelli usually mainly flavous, and hind coxae often distinctly flavous at apex: hind femora sometimes extensively darkened; male coxae and trochanters less often and on the average less extensively darkened than in *quinquecinctus* Grav.: male hind knees inconspicuously pale. Pale margins of tergites often less extensive.

Redescribed from the following material: ENGLAND, unlocalized, 1 ♀, Desvignes coll.; Herts., Brickett Wood, 1 ♂, 5.v.1950, R. B. Benson; Notts., Oxton Bogs, 1 ♀, 14.vii.1915, J. W. Carr: HOLLAND, Venlo, 1 ♀, 21.vi.1942, H. G. M. Teunissen: SWEDEN, Skåne, Lund, 1 ♀, 31.v.1939, W. Hellén; Småland, 'Össt. Lars', 1 ♀, 17.vi.1911 (mus. Stockholm); Stockholm, 2 ♂♂, C. Boheman (one the type); Dalarne, Orsa, 1 ♀, 4.viii.1938, G. J. K.: FINLAND, Karislojo, 1 ♂, 13.vi, R. Forsius; Helsinge, 1 ♀, W. Hellén; Tampere, Aitolahti, 1 ♀, 22.vi.1932, V. Saarinen: SWITZERLAND, Zürich, 1 ♀, Buchecker coll.: GERMANY, probably Berlin district, 1 ♀, Ruthe coll.; Celle, 1 ♂, 25.v.1942, 2 ♀♀, 27.vi.1942, Munster, 1 ♀, 2.viii.1942, R. Hinz; Upper Bavaria, Haag-an-der-Amper, 3 ♂♂, 2 ♀♀, v.1948, G. Heinrich: CZECHOSLOVAKIA, Bohemia, Chodau, 1 ♀, 1.vi.1882, R. von Stein; Bohumin, Haatsch, 1 ♀, 24.vii.1938, Th. Kupka: SIBERIA, Kamtchatka, 2 ♀♀, R. Malaise.

Small pale form has body colour altogether paler: antennal flagellum 22- to 27-segmented: length 5½ to 7 mm.: BELGIUM, Mont St. Aubert, 1 ♀, 1.vi.1878, J. Tosquinet: SWEDEN, Småland, Lommaryd, 1 ♀ (mus. Stockholm): EUROPE, unlocalized, 1 ♀, O. Schmiedeknecht.

Smicroplectrus sibiricus sp. n.

Head rather strongly transverse, more so than in *perkinsorum* sp.n. (Fig. 66); strongly rounded and almost broadened behind eyes; shallowly emarginate behind: finely to moderately and rather densely punctate; lower face more coarsely so. Clypeus rather coarsely punctate; evenly rounded apically; deeply delimited, with tentorial pits conspicuous; scarcely convex basally, but distinctly impressed before apex. Malar space slightly less than distance between mandibular apices. Genal and hypostomal costae much as described for *bohemani* Hlgr.; but the hypostomal less strongly elevated, and the genal meeting it relatively nearer mandibular base. Mandibles with lower tooth contracted, as in *jucundus* Hlgr.

Antennae with scape weakly excised externo-ventrally: flagellum 23-segmented, very little explanate in middle, but rather strongly hairy, and with the segments very distinctly separated.

Pronotum with dorsal transverse shining impression narrow, deeply impressed; with epomiae sharp and of moderate strength; laterally rather coarsely but shallowly and not densely punctate above, longitudinally rugose just behind epomiae and below. Propleura alutaceo-punctate. Mesoscutum very strongly convex anteriorly; with notaulices weakly impressed; moderately punctate, more finely and densely so anteriorly between notaulices. Scutellum rather strongly convex anteriorly, falling rather gradually behind; not margined to middle; shining and almost smooth on disk, finely rugose-punctate at sides and along hind margin. Mesopleura moderately and rather sparsely punctate, with a shining speculum: sternaulices broad, rather superficial: mesosternum shining and finely punctate, sparsely so posteriorly: epicnemial carina very distinctly elevated, not quite complete dorsally: mesolcus deep, transcostate, almost closed behind. Metascutellum moderately raised. Propodeum with costae rather strong and costulae complete; with area externa rugulose-punctate, elsewhere mainly rather strongly rugose: area basalis not delimited apically: area superomedia slightly rounded at sides and behind.

Gaster on tergite 1 mainly, and on 2 to beyond middle, finely rugose; elsewhere shining and moderately punctate, more finely so towards apex. Petiolar segment about 1·5 times length of its greatest breadth (female); distinctly margined; with anterior angles not acutely pointed; with dorsal keels distinct and almost percurrent, though not strong. Tergite 2 with basal diagonal impressions not distinct.

Fore wings with stigma and radial cell relatively broad: stigma about 2·8 times, radial cell about 2·3 times as long as broad. The areolet is relatively a little larger, but in other respects the wings are as described for *quinquecinctus* Grav.

Hind tibiae without the minute spur characteristic of the genus. Tarsal claws weakly pectinate, with only two or three slender teeth.

Length 6 mm.

Coloration of head and body much as in *quinquecinctus* Grav., but the pale colour is purer ivory-white, and the pale margin of the prepectus is reduced to a relatively narrow band on the ventral surface and a pair of rather large lateral marks. Wing veins paler than in *quinquecinctus* Grav. Fore and mid legs mainly pale fulvous; with coxae, trochanters and trochanterelli ivory-white, the coxae darker marked at extreme base: hind legs mainly pale ferrugineous, but with coxae mainly almost black; with femora at apex and tibiae at base conspicuously ivory-white; with coxae at extreme apex, trochanters and trochanterelli in part, and first four tarsal segments basally, ivory-white.

SIBERIA, Yeniseisk, 1 ♀, J. Sahlberg.

Holotype in Royal Natural History Museum, Stockholm.

The white hind knees and absence of a hind tibial spur are characters shared with *annulipes* Cresson and *velox* Walley. H. K. Townes has very kindly sent me a female specimen of each of these nearctic species. Both differ from *sibiricus* as follows: costae of propodeum strong: petiolar segment with dorsal keels very strong; with basal lobes acute-pointed and very prominent: tergite 2 with strong longitudinal rugosities; with diagonal impressions very strong and deep. *S. annulipes* differs also in having the dentiparal area of the propodeum strongly produced, the tarsal claws strongly pectinate, the thorax ventrally red, and the hind tibiae very broadly and distinctly white in the middle. The area posteromedia of *annulipes* I should describe as moderately rugose transversely, not as aciculate, as given by Davis (1897: 233).

Smicroplectrus clémenti sp. n.

Head strongly transverse, more so than in *perkinsorum* sp.n. (Fig. 66); rather strongly narrowed and rounded behind eyes; rather shallowly emarginate behind: on vertical region and temples finely punctate, towards and on greater part of genae rather finely so; near mandibular base, and on inner orbits and upper face moderately punctate, and on epistoma rather coarsely and densely so. Clypeus rather finely punctate above, almost impunctate below; rather deeply delimited; rather strongly and almost evenly convex; moderately rounded at apex. Malar space about three-quarters distance between mandibular apices. Genal costa moderately laminately elevated, bulging outward (Fig. 73), not angularly inflected: gena with no outer costa, but roundedly angled in that position. Hypostomal costa strongly and rather sharply raised.

Antennae with scape weakly excised externo-ventrally: flagellum 24-segmented.

Pronotum with epomiae of moderate strength; laterally rather finely punctate above, finely so below. Propleura very shallowly, moderately to rather coarsely punctate. Mesoscutum rather strongly convex; with notaulices rather deeply impressed for a short distance near, but not reaching anterior margin; finely to rather finely punctate. Scutellum moderately convex, rather irregularly punctate, margined to about middle. Mesopleura moderately and not densely punctate below, rather finely so above, with speculum rather extensive: sternaulices broad, moderately impressed: mesosternum finely and densely punctate: epicnemial carina rather strongly raised: mesolcus sharply impressed, closed behind. Propodeum with costae of moderate strength and costulae complete; rather finely rugose, with area pleuralis in greater part and area externa discretely punctate: area superomedia a little broader than long, basally delimited.

Gaster with tergites 1 and 2 mainly, and 3 at base, weakly coriaceo-rugose; elsewhere shining and finely punctate. Petiolar segment relatively long, 2·0 times length of its greatest breadth; distinctly margined, with basal lobes pointed and with spiracular tubercles rather prominent; rather much raised in middle, but with dorsal keels not strong and not distinct much beyond half length of segment.

Wings as described for *quinquecinctus* Grav., but basal and disco-cubital veins distinctly divergent, the basal meeting the first cubital at an acute angle.

Legs rather short and stout, about as in *perkinsorum* sp.n.: hind tibiae without the minute spur characteristic of the genus: tarsal claws not pectinate.

Length 6½ mm.

Differs in coloration from *quinquecinctus* Grav. as follows: pale colour mostly bright flavous, extending some way up orbits of upper face, that on antennae scarcely merging to fulvous: colour pattern of thorax as described for *perkinsorum* sp. n. (p. 407). Leg colour much as described for *sibiricus* sp.n. (p. 404), but fore and mid coxae and trochanters mainly pale flavous, hind knees not nearly so conspicuously pale, and hind tibiae broadly luteous in middle. Gaster pale ferrugineous, the margins bright flavous.

AUSTRIA, 'Carinth. alp.', 1 ♀, C. Boheman.

Holotype in Royal Natural History Museum, Stockholm.

Dedicated to the late Ernst Clément, in recognition of his pioneer work on the intensive revision of groups of European Ichneumonidae.

It seems very likely that this unique specimen is a small pale form of a species normally larger and darker.

Smicroplectrus perkinsorum sp. n.

Head (Fig. 66) rather strongly transverse; moderately narrowed and rounded behind eyes; rather shallowly emarginate behind; in side view (Fig. 67): on vertical region and temples finely and rather closely punctate, the punctures becoming gradually coarser towards mandibular articulation: genae rather finely to moderately and epistoma moderately punctate; upper face densely and rather finely so. Clypeus as described for *quinquecinctus* Grav., but more sharply delimited basally, and usually more broadly rounded at apex (considerable variation in this): the punctation also is weaker in smaller specimens. Malar space slightly less than distance between mandibular apices in female, distinctly less in male. Genal costa sharply carinate but not laminate, not angularly inflected: gena falling to a deep, longitudinal pit beside hypostomal costa; the pit bounded externally by a sharp angulation of the gena. Hypostomal costa (visible in Fig. 67) exceptionally strongly elevated and acutely, or almost acutely, round-pointed below junction of genal costa; falling evenly to foramen magnum.

Antennae with scape weakly or rather weakly excised externo-ventrally: flagellum 21- to 26-segmented, relatively short and thick, and not much attenuate to apex.

Pronotum with dorsal transverse shining impression narrow; distinctly rugose-punctate before it; with epomiae sharp and rather strong; moderately and densely punctate above, more or less longitudinally rugose below. Propleura rather coarsely but shallowly punctate. Mesoscutum rising rather sharply from pronotum; with notaulices broad and strongly impressed anteriorly, running far beyond middle and falling into a median depression; finely to rather finely punctate. Scutellum weakly convex; moderately and rather irregularly punctate; margined to about middle; more or less impressed on disk. Mesopleura rather coarsely punctate, with speculum large: sternaulices broad, rather shallowly impressed in female, shallowly in male: mesosternum rather finely punctate, sparsely so behind: prepectus rugose-punctate at sides, very deeply excavate: epicnemial carina distinctly but not at all strongly raised: mesolcus very deeply impressed, incompletely closed behind. Metascutellum short, moderately raised. Propodeum with costae relatively weak or rather weak; with costulae complete or incomplete, always indicated but sometimes indefinite internally and usually so externally; finely rugose including the area pleuralis, which is often somewhat shining but not discretely punctate; with area posteromedia rather more strongly rugose, having a median longitudinal carina at least indicated posteriorly but usually almost complete: area basalis delimited or not delimited apically: area superomedia of rather inconstant shape, more or less explanate to near apex, moderately rounded to almost truncate behind, usually emitting costulae well behind middle.

Gaster on tergite 1 mainly, and 2 and 3 at base, coriaceo-rugose; elsewhere finely alutaceo-punctate, not matt but generally not strongly shining. Petiolar segment (Fig. 75) relatively elongate, 1·8 to 2·2 times length of its greatest breadth; not strongly margined; with basal lobes very bluntly rounded, or at any rate of similar general shape; with dorsal keels rather weak, extending to rather near apex. Tergite 2 with diagonal basal impressions indistinct.

Fore wings with stigma and radial cell relatively broad: stigma about 3·0 times (varying 2·8 to 3·3), radial cell 2·1 to 2·6 times as long as broad: with areolet sometimes longer petiolate: in other respects the wings are as described for *quinquecinctus* Grav.

Legs relatively stouter than in *quinquecinctus* Grav., particularly the tibiae: tarsal claws distinctly, but weakly or rather weakly pectinate.

Length of normal form 6 to 8 mm.

Differs in coloration from *quinquecinctus* Grav. as follows: genae on the average more narrowly yellow: pale colouring frequently extending well up orbits of upper face in female: scape and pedicellus below with pale coloration usually duller and more restricted. Propleura often largely black in female: pale coloration of pronotum more restricted: pale margin of prepectus represented by a narrow transverse line in middle and a pair of lateral dots, but these sometimes undeveloped in female, as almost always in male: no fulvous colouring on thorax. In both sexes the fore and mid coxae are usually to a greater or lesser extent dark, and the hind coxae and trochanters mainly black or almost so: all trochanterelli flavous: hind femora often extensively darkened: hind tibiae and tarsi not nearly black, but ferrugineous or paler. Pale margins of tergites rather less extensive than in *quinquecinctus*, the pale coloration stramineous to pale flavous.

Described from the following material: ENGLAND, unlocalized, 1 ♂, 3 ♀♀, T. Desvignes coll.; Cornwall, Botusfleming, 1 ♀, T. A. Marshall; Devon, Lustleigh, 1 ♀, 11.vii.1934, R. C. L. Perkins (type), 1 ♂, 23.v, 1 ♂, 1 ♀, 3.vi.1933, J. F. Perkins; Bovey Tracey, 1 ♀, viii.1933, Dartmoor, 2 ♂♂, 1 ♀, 8–25.vi.1935, 1 ♂, vi.1938, R. C. L. Perkins; Newton Abbot, 1 ♂, 22.vi.1938, R. C. L. Perkins, 3 ♂♂, vi.1941, 1 ♂, 1 ♀, 10.vi, 1 ♂, 2 ♀♀, 14.vi, 1 ♀, 16.vi.1941, 1 ♀, vi.1942, J. F. Perkins (some taken on wild rose); Kingsteignton, Starks Ponds, 10 ♂♂, 2 ♀♀, 24.v–5.vi.1942, J. F. Perkins; Highweek, 9 ♂♂, 1 ♀, 22.v–9.vi.1942, D. M. S. Perkins and J. F. Perkins; Dunsford, 1♂, vi.1941, Milber, 1 ♀, vii.1941, J. F. Perkins; Dorset, Studland Heath, 1 ♂, 6.vi.1928, R. B. Benson; Oxon., Henley, 1 ♀, 25.vi.1906, H. Scott; Surrey, Oxshott, 1 ♂, 28.v.1933, J. F. Perkins; Bucks., Beaconsfield, 1 ♂, 27.v.1934, J. F. Perkins; Herts., Brickett Wood, 1 ♂, 17.vi.1936, Brickhill, 1 ♀, 21.v.1937, R. B. Benson; Suffolk, Sudbury, 1 ♀, 1926, Essex, Wivenhoe, 1 ♀, 25.v.1915, W. B. or B. S. Harwood; Yorks., Holmhouse Wood, 1 ♀, 15.vi.1935, J. Wood: BELGIUM, Stockel, 1 ♀, 10.vi.1890, Steinbach, 1 ♀, 12.vi.1896, Rhode St. Genèse, 1 ♀, 27.vi.1884, Mont l'Enclus, 1 ♀, 4.vii.1890, J. Tosquinet: HOLLAND, Babberich, 1 ♀, 14.vi.1941, Venlo, 2 ♂♂, 30.v–1.vi.1942, H. G. M. Teunissen: FINLAND, Kirjavalaks, 1 ♂, W. Hellén; Isthmus karelicus, Rajajoki, 1 ♀, 17.vi.1934, K. Lahtivirta: FRANCE, Paris district, Maisons Laffitte, 1 ♀, 24.v, J. de Gaulle: GERMANY, Köln, 1 ♂, 12.v.1942, W. Aerts; Celle, 1 ♂, 25.v.1942, Hannover, 1 ♂, 8.vi.1948, R. Hinz; Blankenburg-i-Thüringen, 1 ♀, 1.vi.1924, H. Hedicke (mus. Paris); Odenwald, 1 ♂, 20.v.1939, Th. Kupka; Bavaria, Erzgebirge, Görkau, 1 ♂, Th. Kupka; Bodmann am Bodensee, 1 ♀, 28.v.1949, G. Heinrich.

The small, pale form of this species has the body colour altogether paler than that of the typical form: the hind tibiae are pale ochreous; and the gaster is pale ferrugineous, with the margins of the tergites sometimes bright flavous. Agreeing in structure with the typical form. Antennal flagellum 22- to 25-segmented: length 5 to 6½ mm. Described from the following: ENGLAND, unlocalized, 1 ♀, T. Desvignes: CZECHOSLOVAKIA, Erzgebirge, Aussig, 2 ♀♀, 17.vi.1934; unlocalized, 2 ♂♂, Th. Kupka.

Holotype ♀ in British Museum (Natural History).

Structurally, this is the most distinct species of *Smicroplectrus* in Europe. It is also distinct in having been taken on wild rose; but it has not yet been bred, and this association remains to be investigated.

I have much pleasure in dedicating this species to Dr. R. C. L. Perkins and to Mr. and Mrs. J. F. Perkins.

Smicroplectrus heinrichi sp. n.

1949 *Smicroplectrus jucundus* Heinrich, *Mitt. München. ent. Ges.* **35–39:** 121 (*non* Holmgren 1858).

Head moderately to rather strongly narrowed and rounded behind eyes; rather shallowly emarginate behind: on vertical region rather finely, and on temples, cheeks, inner orbits, and upper face moderately and densely punctate, confluently so just above antennae; epistoma coarsely and usually confluently punctate, often longitudinally rugose medially. Clypeus rather sparsely punctate, moderately so above, more finely so below; sharply delimited; distinctly but not strongly convex in basal half; usually narrowly rounded at apex. Malar space almost equal to distance between mandibular apices in female, distinctly less in male. Genal costa carinate but not laminate, except near junction with hypostomal; not angularly inflected, meeting hypostomal costa far behind mandibular base (Fig. 72); gena with no outer costa, evenly rounded in that position as seen from behind, almost straight-sided in lateral view: genal pit sometimes indicated. Hypostomal costa moderately raised, somewhat pointed below junction with genal costa. Second segment of maxillary palpi strongly swollen in female.

Antennae with scape weakly or rather weakly excised externo-ventrally, generally rather short: flagellum 23- to 27-segmented.

Pronotum with dorsal transverse furrow rather broad, shining; with epomiae of moderate strength; laterally moderately and densely punctate. Propleura densely and rather coarsely punctate. Mesoscutum much as described for *bohemani* Hlgr., but the punctation finer. Scutellum rather finely to moderately and not sparsely punctate above, usually more coarsely and densely so behind; usually strongly convex and not margined beyond scutellar fovea, but often less convex and more or less longitudinally impressed on disk. Mesopleura rather coarsely and densely punctate below, not much less so above, and with a shining speculum: sternaulices weakly or moderately impressed: mesosternum finely and densely punctate, prepectus coarsely and densely so: epicnemial carina scarcely raised: mesolcus usually rather weakly impressed, greatly broadened in posterior half, more or less closed behind. Propodeum with costae of moderate strength or rather strong, and with costulae generally complete but occasionally absent; in greater part rugose, very finely to moderately so; sometimes rugose on greater part of area pleuralis, but area externa generally discretely, extremely finely punctate: area superomedia usually smooth, not delimited basally.

Gaster on tergites 1 and 2 mainly, and 3 at base, coriaceo-rugose; elsewhere strongly shining, moderately punctate on tergite 3, more and more finely so towards apex. Petiolar segment as described for *quinquecinctus* Grav.; 1·4 to 2·2, usually about 1¾ times length of its greatest breadth.

Wings as described for *quinquecinctus* Grav., but radial cell sometimes relatively short in male.

Legs slender, as in *quinquecinctus* Grav.: tarsal claws generally (but not in Swedish specimen) rather strongly pectinate, with about four rather long, outwardly pointing comb-teeth.

Length 6 to 8½ mm.

Differs in coloration from *quinquecinctus* Grav. as follows: the ivory-white purer, much less suffused with flavous. Pale colouring sometimes extending up orbits of upper face in female, and sometimes much more restricted on antenna. Pale apical marks of scutellum and metascutellum small or, more often, undeveloped in female, not developed in any male seen: no fulvous colouring on thorax. Leg colour much as described for *bohemani*, but male hind coxae on the average darker. Pale margins of tergites sometimes less extensive.

Described from the following material: IRELAND, Co. West Mayo, Old Head, 1 ♂, 3 ♀♀ (one the type), 28.v.1942, Co. Kildare, Sallins, 1 ♀, 17.v.1933, A. W. Stelfox; Co. Wicklow, Athdown, 1 ♂, 1.v.1933, J. F. Perkins; George's Bridge, 1 ♂, 1.v.1949, A. W. Stelfox; Co. Dublin, Glenasmole, 1 ♂, 23.v.1930, 2 ♂♂, 3.vi.1934, 1 ♂, 21.v.1939, 1 ♂, 20.v.1949, A. W. Stelfox, Dublin dist., 1 ♀, *ex* sawfly larva, em. *c*. 4.v.1932, G. C. Scott: SCOTLAND, Cairngorm Mts., Aviemore, 1 ♂, G. C. Champion (recorded as *jucundus* Hlgr., Bridgman, 1889: 434): BELGIUM, 1 ♀, coll. C. Wesmael: HOLLAND, Tilburg, 1 ♀, 4.iv.1941, coll. Adriaanse; Kijfhoek, 1 ♀, 17.v.1936, H. G. M. Teunissen (recorded as *jucundus* Hlgr., Teunissen, 1948): SWEDEN, Skåne, Skäralid, 1 ♀, 3.vii. 1938, J. F. Perkins: FINLAND, Munksnäs, 1 ♀ *ex* Nematine sawfly larva, em. 5.iv.1940, E. Lindqvist: SWITZERLAND, Valais, Arolla, 1 ♀, *ex* larva *Amauronematus* sp. on *Salix*, em. iv.1936, R. B. Benson: GERMANY, Helzen, 1 ♂, 13.v.1943, R. Hinz; Bavaria, Haag-an-der-Amper, 5 ♂♂, 5 ♀♀, v.1948, Bodmann am Bodensee, 1 ♂, 25.iv.1949, G. Heinrich.

Holotype ♀ in British Museum (Natural History), kindly presented by Mr. A. W. Stelfox.

I first received this species in good series from Ireland from A. W. Stelfox: later, when a good Alpine series came from G. Heinrich, I was able to appreciate its chief characteristic. Heinrich's rich material of *Smicroplectrus* has been especially valuable in the elucidation thus far of this difficult genus.

Smicroplectrus jucundus Holmgren

1858 *Exenterus jucundus* Holmgren, *Svensk. Vet.-Akad. Handl.* **1:** 227 (*non* Heinrich 1949).
1883 *Smicroplectrus jucundus* Thomson, *Opuscula Entomologica*, fasc. 9: 888.
1883 *Smicroplectrus costulatus* Thomson, ibid.: 888.
1913 *Smicroplectrus Bohemani* Roman (*pars*), *Ent. Tidskr.* **34:** 128.

Head moderately transverse (more so than in *quinquecinctus* Grav.); slightly to moderately narrowed and strongly rounded behind eyes; deeply emarginate behind; in lateral view relatively short, and with vertical region rather strongly elevated (Fig. 68): shining, moderately, or in small specimens rather finely, and somewhat densely punctate; with gena less densely and upper face much more densely so; epistoma usually distinctly alutaceous, rather coarsely to coarsely punctate, often in larger specimens rugulose-punctate (but not in lectotype): eyes very distinctly divergent in female but much less so in male. Clypeus almost impunctate below, sparsely punctate, with coarser and finer punctures, above; rather narrowly rounded apically; not strongly convex and often not deeply delimited, though with tentorial pits conspicuous. Malar space much longer than distance between mandibular apices in female, slightly shorter in male. Genal costa single, carinate; not strongly inflected, but meeting the hypostomal at less than a right angle (Fig. 71). Hypostomal costa distinctly and more or less laminately elevated, but not at all strongly so for a *Smicroplectrus*, its height being only about a quarter the distance of the junction with the genal costa from the base of the mandible. Mandibles with lower tooth contracted.

Antennae with scape very weakly excised externo-ventrally: flagellum normally 21- to 24-segmented, relatively short and thick, and very little attenuate to apex.

Pronotum with dorsal transverse shining impression narrow, rather deeply impressed, usually longitudinally costate; with epomiae sharp but rather weak; laterally moderately to rather coarsely and closely punctate above, rugulose-punctate below. Propleura rather densely and coarsely punctate. Mesoscutum rather weakly to moderately convex anteriorly, but rather regularly rounded, not so much flattened before the scutellum as in other species here described; with notaulices moderately or rather strongly impressed and often transcostate anteriorly; finely to moderately punctate, more finely and densely so anteriorly between notaulices; generally strongly shining but sometimes conspicuously alutaceous (it is so in type of *costulatus* Thoms.). Scutellum very strongly convex; moderately punctate above, weakly and irregularly rugose-punctate at sides, finely rugose behind; not or weakly margined to middle. Mesopleura above moderately, below coarsely punctate; sternaulices broad and not deeply impressed: mesosternum densely and finely, prepectus densely and rather coarsely punctate: mesolcus usually not deeply impressed, very narrow till near hind end of sternum, where it is usually crossed by several transverse rugosities: epicnemial carina not elevated; but in female the prepectus is somewhat bent over ventrally. Propodeum with costae moderately strong; with dentiparal areae more or less weakly produced and with costulae complete or incomplete, sometimes scarcely indicated; finely coriaceous, but with the area pleuralis often distinctly finely punctate (it is so in type of *costulatus* Thoms.) and the area posteromedia rugose: area basalis not or scarcely delimited apically.

Gaster on tergites 1 and 2 mainly, and 3 and sometimes 4 at base, coriaceous; elsewhere alutaceo-punctate towards base of segments, at least in larger specimens, finely and sparsely punctate and shining towards apex. Petiolar segment 1·4 to 1·9 times length of its greatest breadth, but with the longer form predominating; with basal lobes generally obtusely pointed or almost rounded; with dorsal keels not very strong, usually indefinite in apical third. Tergite 2 with diagonal basal impressions indistinct.

Fore wings with stigma about 3·3 times, radial cell about 2·6 times as long as broad: hind wings with nervellus intercepted distinctly below middle: wings otherwise as described for *quinquecinctus* Grav.

Legs of normal, slender form in female, rather stouter in male. Hind tibiae with spur relatively short even for this genus. Tarsal claws rather strongly but finely pectinate.

Length normally 6 to 8½ mm. Length of small, pale form 4½ to 6 mm.: flagellum may be 18- to 19-segmented.

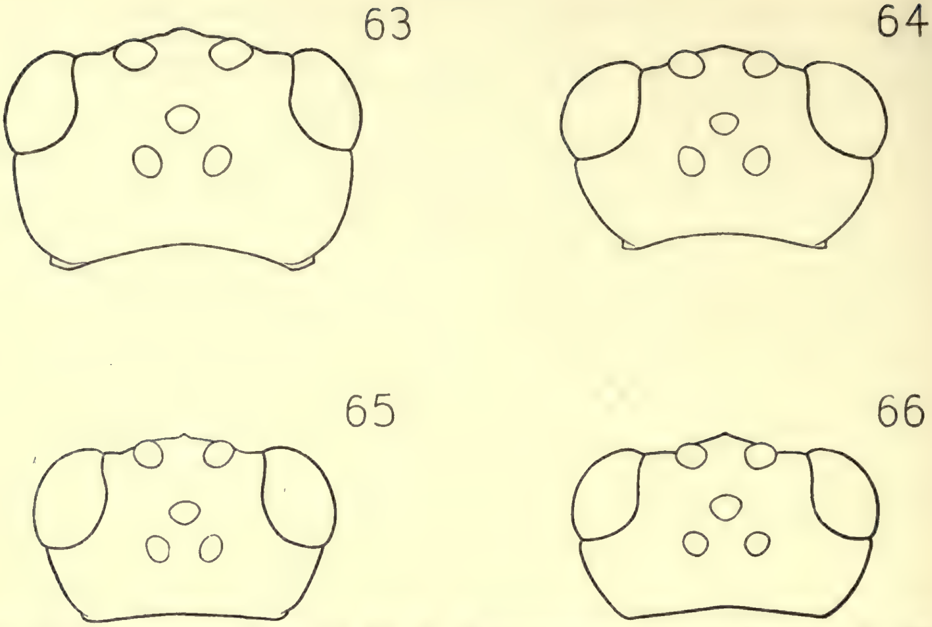
Differs in coloration from *quinquecinctus* Grav. as follows: ivory-white usually much purer, with very little flavous colouring. In female, the pale facial colour usually extends up the orbits of upper face almost to the top of the eye (though sometimes leaving a detached pale spot); but in male it is more restricted, often to a pair of incomplete bands on the orbits of the lower face and a median heart-shaped mark above the clypeus: pale colour of genae very restricted in male. In female the whole fore margin of the mesopleuron may be pale, and the pale markings of scutellum and metascutellum very restricted or entirely absent: in male the usual pale markings of the thorax are mostly or entirely absent, though the tegulae are stramineous in both sexes. The hind coxae and trochanters are fulvous in the English and black in the majority of continental specimens, flavous at apex: hind femora and tibiae fulvous to ferrugineous. Wing veins and stigma tending to be rather paler, especially in male. As described by Holmgren, tergites 5 to 7 of female may be almost wholly ivory-white.

Redescribed from the following material: ENGLAND, Surrey, Byfleet, *ex* larva *Amauronematus amplux* Kon. (Tenthredinidae) on *Betula* (larva vi.1947), 1 ♀ em. iv.1948, R. B. Benson; Herts., Brickett Wood, 2 ♂♂, 2.v.1949, 1 ♀, 23.v.1950, 1 ♀ em. iii.1945 *ex* larva *Amauronematus* sp. on *Salix*, R. B. Benson; Hunts., Woodwalton, 1 ♀, 21–23.v.1949, R. B. Benson: SWEDEN, Lapland, 4 ♂♂, 4 ♀♀, including 1 ♂, 2 ♀♀ of small, pale form 'ad Qvickjock (D. D. Boheman et Wahlberg), ad Umefors (ipse)' (Holmgren, 1858: 227); Lapland (no further data), 2 ♂♂, 4 ♀♀, including type to the description, under *jucundus* Hlgr. in Thomson coll. (one female a small, pale form), 1 ♀ (unique type of *costulatus* Thoms.): FINLAND, Pihtipudas, 2 ♀♀, 7.vi, 1 ♀, 9.vi. 1945, Borgå, 1 ♀, Ivalo, 1 ♂, 2 ♀♀, Parikkala, 2 ♀♀, Haapajärvi, 1 ♀, 3.vi.1945, W. Hellén; Saana, 1 ♂, Nordman; Kouvola, 1 ♂, 24.v.1940, V. Karvonen; Tampere, P. Pirkkala, 1 ♀, 27.v.1934, A. Saarinen, Aitolahti, 1 ♀, 12.vi.1932, V. Saarinen: SWITZERLAND, Valais, Ferpècle, 5,000–8,000 ft., 4 ♂♂, 2 ♀♀, 14–27.vi.1935, R. B. Benson: GERMANY, Bavaria, Bodmann am Bodensee, 1 ♂, 25.iv, 1 ♀, 23.v.1949, G. Heinrich.

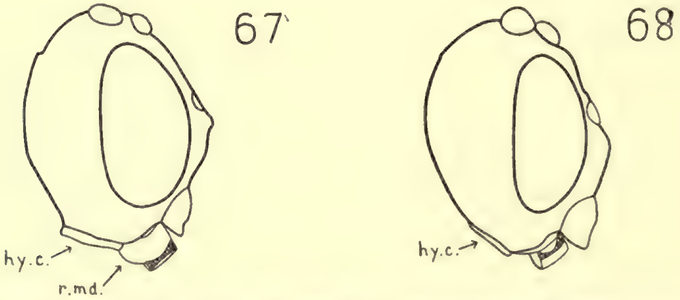
Through the kindness of Dr. Kjell Ander I was able in 1947 to take the Thomson material from Lund, and make direct comparison with the Holmgren material in Stockholm. A. Roman's lectotype is a female specimen taken by P. Wahlberg.

Records of *jucundus* from Belgium, Holland, Scotland, and the northern midlands of England are, in this paper, referred to other species. The European distribution as now known to me is arctic and sub-arctic, Alpine and sub-Alpine, and both sides of London in southern England. How much importance can be attached, in the present state of our knowledge, to negative evidence from the middle European plains remains to be seen; but R. B. Benson points out to me that this corresponds with the Siberian type of distribution (see Benson, 1950).

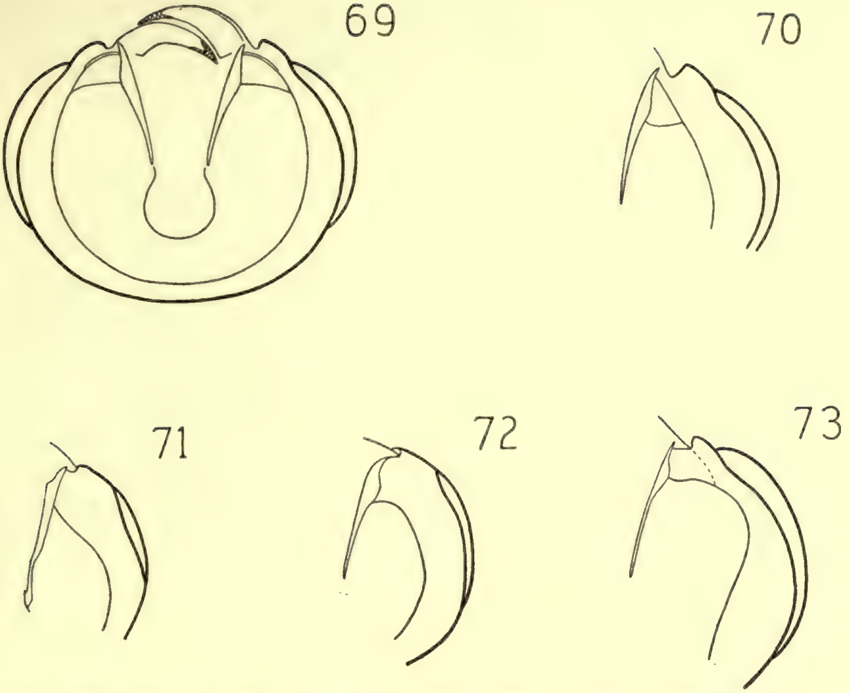
Three female and three male specimens from Mt. Rainier, Washington, U.S.A., taken by H. K. Townes and determined by him as *albilineatus* Walsh, are extremely



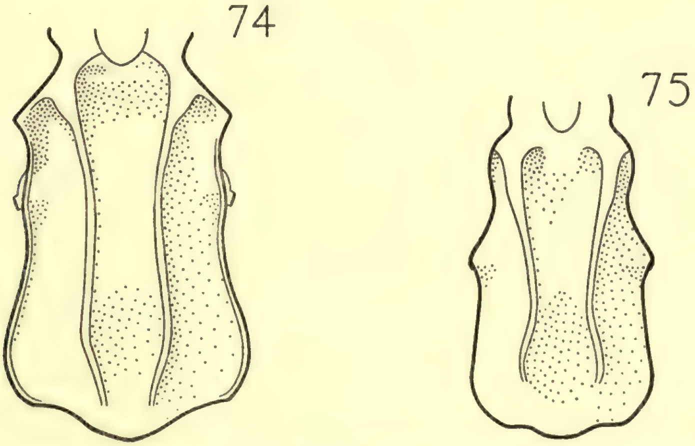
Figs. 63–66. Head from above of Fig. 63. *Smicroplectrus quinquecinctus* Grav. ♀. Fig. 64. *Smicroplectrus quinquecinctus* Grav. ♂. Fig. 65. *Smicroplectrus excisus* sp. n. Fig. 66. *Smicroplectrus perkinsorum* sp. n.



Figs. 67–68. Head in dextro-lateral view of Fig. 67. *Smicroplectrus perkinsorum* sp.n. Fig. 68. *Smicroplectrus jucundus* Hlgr. *hy.c.* = hypostomal costa, *r.md.* = right mandible.



Figs. 69–73. Head in hind view of Fig. 69. *Smicroplectrus quinquecinctus* Grav. Fig. 70. *Smicroplectrus trianguligena* sp. n. Fig. 71. *Smicroplectrus jucundus* Hlgr. Fig. 72. *Smicroplectrus heinrichi* sp.n. Fig. 73. *Smicroplectrus clémenti* sp. n. Figs. 69–72 to same scale, Fig. 73 larger.



Figs. 74–75. Petiolar segment of Fig. 74. *Smicroplectrus quinquecinctus* Grav. Fig. 75. *Smicroplectrus perkinsorum* sp. n.

similar to the European material on which the description of *jucundus* was based, and agree with the description in all respects. I do not, however, propose the placing of *albilineatus* Walsh in synonymy; but leave the problem with W. R. M. Mason, for reasons that will emerge when his revision of the nearctic species is published.

Key to Palaearctic Species of *Smicroplectrus* Thomson

1. Male antennae pale-banded: female unknown: Japan . *quadriceps* Uchida
   Female known, and male of all but two species: antennae not pale-banded . 2

2. Hypostomal costa exceptionally strongly laminate (to be seen in Fig. 67), acute-angled or almost so below junction of genal costa, which is not laminate: gena falling to a deep, longitudinal pit beside hypostomal costa, bounded externally by a sharp angulation of the gena: head strongly transverse (Fig. 66): fore wings with stigma and radial cell relatively broad (see description): petiolar segment relatively elongate, with basal lobes rounded (Fig. 75), or at any rate of similar shape . . . . *perkinsorum* sp. nov.
   If the gena has an outer costa or is angulate or strongly rounded in that position, the genal costa is laminately elevated: head not so transverse except in non-spurred species (couplet 7): in other respects not as above . . . 3

3. Genal costa carinate, but not laminate, neither double nor angled in position of outer costa: no distinct genal pit 4
   Genal costa moderately or strongly laminate, not as in the two following species (Figs. 71 and 72) 5

4. Head, notably eyes (viewed laterally), short (Fig. 68, cf. Fig. 67), with vertical region rather strongly elevated: genal costa not strongly inflected, but meeting hypostomal costa at distinctly less than a right angle (Fig. 71): hypostomal costa weakly elevated, the height being only about a quarter the distance of the junction of the genal costa from mandibular base . . *jucundus* Hlgr.
   Head not so short (similar to Fig. 67), nor vertical region thus elevated: hypostomal costa moderately elevated, met by genal costa at nearly a right angle far behind mandibular base (Fig. 72) . . . *heinrichi* sp. nov.

5. Gena with no outer costa, but strongly rounded in that position: genal costa moderately laminate 6
   Gena with an outer costa, at least in part, or sharply angulate in that position 8

6. Head less transverse than in *perkinsorum* sp.n. (Fig. 66): genal costa normally curved, meeting hypostomal a moderate distance behind mandibular base, about as in *quinquecinctus* Grav. (Fig. 69): hind tibia with the minute spur characteristic of the genus: [hind knees not conspicuously pale] . . . . *bohemani* Hlgr.
   Head more transverse than in *perkinsorum* sp.n. (Fig. 66): genal costa meeting hypostomal much nearer mandibular base: hind tibia without the minute spur characteristic of the genus 7

7. Genal costa not bulging outward as in alternate: petiolar segment about 1½ times

length of its greatest breadth: basal and disco-cubital veins (as in most species) nearly parallel: [hind knees conspicuously pale] . . . *sibiricus* sp.n.

Genal costa bulging very distinctly outward (Fig. 73): petiolar segment about twice length of its greatest breadth: basal and disco-cubital veins distinctly divergent . . . . *clémenti* sp. n.

8. Genal costa moderately raised: genal pit (Fig. 70) triangular, usually longer along hypostomal costa than its length along genal: [differs from *quinquecinctus* Grav. in having the gaster mainly shining, and from *excisus* sp.n. in the shapes of the antennal scape and hind metatarsi] . . . . *trianguligena* sp.n.

Genal costa strongly laminately raised: genal pit distinctly broader along genal costa than its length along hypostomal (Fig. 69) 9

9. Scape of normal form, weakly excised externo-ventrally (Fig. 60): legs of normal slender form, the hind metatarsus about 7 times length of its greatest breadth in inner side view in female, 6 to 7 times in male: gaster mainly alutaceo-punctate, more or less matt . . . . . *quinquecinctus* Grav.

Scape strongly convex above and very deeply excised externo-ventrally, its ventral being less than half its dorsal length (Fig. 61): legs relatively stout, the hind metatarsus about 5½ times length of its greatest breadth in same view (Fig. 62): gaster mainly strongly shining . . . . *excisus* sp. n.

Genus *EUDIABORUS*, gen. n.

Diaborus Förster, Thomson 1883 *non* Woldstedt 1877.

This genus was diagnosed by Förster (1868) without included species. It was taken up by Thomson (1883); and Roman (1939) showed that it was the genus that Förster actually had. However, as has been recorded earlier in the present paper, Woldstedt had, in the meantime (1877), included two species neither of which belongs to the genus in question; and *Diaborus* has to take *sedulus* Woldst. as type, by designation of Viereck 1912. To fill the lacuna the present writer has (p. 315 above) proposed *Eudiaborus* as a new genus, taking as type the best-known species *pallitarsis* Thoms.

Thomson included four species he described as new; and a fifth, with normal third valvulae and seemingly attached to conifer woods, which he interpreted as *lituratorius* L. It is, however, evident that Thunberg (1822, as recorded by Roman, 1912), Zetterstedt (1840), Holmgren (1858), Brischke (1878), and later Schmiedeknecht (1911) had more than one species mixed under the name *lituratorius*.

Gravenhorst (1829) described a species, *Tryphon scalaris*, based on males; and a second form, based on females, two with similar data, which he called *Tryphon sexlituratus*. He placed *scalaris*, which had page priority, as questionably the male of *sexlituratus*; and placed *sexlituratus* doubtfully in synonymy with *lituratorius* L. Pfankuch (1906) associated these Gravenhorst species with the present genus, and placed both in synonymy with *lituratorius*.

Roman (1909) described an arctic species *glutiniatus*, with a variety *inversus* which he later (1931*b*) recognized as a good species. Gregor (1937) described a new form *moravica*, which he placed as a subspecies of *lituratorius*; but he added that it might well be a good species. The above I believe to be the sum total of European species described.

Roman (1932), in the course of a revision of the types in the collection of the Linnean Society of London, showed that *lituratorius* L. does not belong to this tribe at all, but is actually *Hypsantyx impressus* Grav. He put forward *scalaris* Grav. as the first available name for *lituratorius* auctt.

Later (1939) he revised the Thomson species. He considered *lituratorius* Thoms. as an atavistic form of *lituratorius* auctt. with normal third valvulae, and added *filipalpis* Thoms. to this aggregate. He also placed *nigrifrons* Thoms. in synonymy with *pallitarsis* Thoms. I do not think that these interpretations will be upheld; for J. F. Perkins has, in the British Museum collection, arranged provisionally under the four Thomson species, forms that accord with Thomson's diagnoses and which do seem to be good species. Roman's identification of *pallitarsis* Thoms. as a species to be found in abundance parasitizing *Nematus* (*Pteronidea*) *ribesii* Scop. was, however, helpful.

Now Schmiedeknecht was evidently unable to comprehend those parts of Thomson's monograph written in the Swedish language. He merely translated (1911) Thomson's Latin diagnoses of the four new species; and he erected a barrier to further understanding of the genus by giving a key to species, according to which the lower face should not be wholly yellowish-white except in the female of '*lituratorius*'. This was completely contrary to what Thomson wrote in his remarks on the genus. It is clear that *lituratorius* or, since 1932, *scalaris*, has come simply to signify any *Diaborus* Thoms. that any student of Ichneumonidae could not place in any of the other described species.

The genus requires complete revision with the aid of larger material than has been available and, when this has been done, the Gravenhorst and Thomson types should again be examined. I do not, however, see any reason to identify *scalaris* Grav. with *lituratorius* Thoms. *non* L. I think it far more likely to be *pallitarsis* Thoms.; and it should not stand in any publication as a separate species without other interpretation.

In order to make Thomson's introduction to the genus (p. 888) more widely available to students of Ichneumonidae, I give below an English translation of it. I do so by courtesy of Håkan Ohlssons Boktryckeri, Lund; and Dr. Kjell Ander has very kindly checked it for me, and corrected it in one particular. I have thought it better to give as nearly as possible a literal translation, so that the English words can be compared with those used by Thomson.

'*Note*. The following colour-pattern is common to all species: the face together with the cheeks and mouth-parts, a line on the pronotum in front of the tegula and one on the lower margin, a mark on the scutellum and also the under side of the antennal scape are white-yellow; almost white are the coxae and trochanters of the fore legs and also the median triangular marks on the hind margins of the dorsal segments, the femora are more reddish, the tarsi and tibiae sometimes of the same colour, the under side of the breast is in the female almost without exception yellowish and closely pilose. All the specimens of *D. frontalis*, which were found on a willow-bank at Örtofta, bred from *Nematus Westermanni* show no variation in the yellow-white orbits of the frons nor in the almost rose-red hind margin of the second dorsal segment, wherefore I believe that the colour in these species is constant and can be used as a basis for species-determination.'

Eudiaborus glutiniatus Roman

FINLAND, Kuusamo, Paanajärvi, Ruskeakallio, bog behind cliff, 1 ♀, 9.viii.1935, G. J. K.

I give a figure of the under side of the apex of the female gaster (Fig. 76) to illustrate the peculiar glutiniae (third valvulae) in this species.

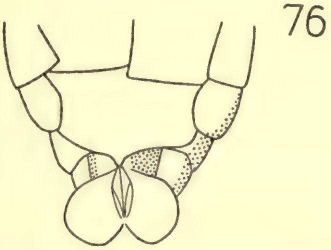


FIG. 76. Apical segments of gaster, from beneath, of *Eudiaborus glutiniatus* Roman, illustrating especially the glutiniae (third valvulae).

A. Roman told me he regarded this species as not uncommon in the Arctic, but that he did consider his capture of it at about 62° latitude as remarkable.

Mason (1951, April: 228) has now recorded this as a North American species.

Eudiaborus boreoalpinus sp.n.

1940 *Diaborus nigrifrons* var. *pallitarsis* Hedwig, *Z. Ent. Breslau*, **18** (4) (*non* Thomson 1883).

Head (Fig. 77) more nearly cubical than in *pallitarsis* Thoms. and other palaearctic species seen; seen from above about two-thirds length of its greatest width across eyes, and sometimes as much as 1·5 times eye length behind eye; only slightly narrowed behind eyes till near hind margin, but slightly more rounded in male; deeply emarginate behind: on vertical region, temples and upper genae rather coarsely but quite discretely punctate, on lower genae and upper face much more closely so; lower face coarsely and, in part, confluently punctate on an alutaceous background, sometimes a little smoother medially. Clypeus sparsely beset with punctures, fine to rather coarse; fairly sharply and not deeply delimited; more or less weakly convex and usually rather narrowly rounded apically. Hypostomal costa not so strongly bent outwards as in *pallitarsis* Thoms.; rather evenly raised to where met by genal costa, a little farther behind mandibular base than width of malar space. Malar space about equal to distance between mandibular apices, or a very little wider.

Antennae with scape of moderate proportions, rather more elongate than in *pallitarsis* Thoms., and with a rather sharp ventro-lateral excision (but some variation in this): with flagellum rather slender, 24- to 28-segmented.

Pronotum with dorsal transverse furrow deeply and sharply impressed; with epomiae of moderate strength, sometimes sharp; laterally moderately and rather closely punctate above, rugose below. Propleura rather closely punctate, moderately so behind, more coarsely in front. Mesoscutum moderately to strongly convex, but not rising sharply from pronotum; with notaulices rather short, rather weakly or moderately impressed; moderately and unevenly punctate. Scutellum usually weakly convex; finely and often rather sparsely punctate above, moderately so on sides; not margined far beyond the broad scutellar fovea. Mesopleura moderately and closely punctate, more coarsely and sparsely so in middle: sternaulices broad, shallowly impressed: mesosternum less concave than in *pallitarsis* Thoms., rather finely and very closely punctate, prepectus moderately and closely so: epicnemial carina almost rectilinear between notaulices, very little incised medially: mesolcus not deeply impressed, more or less closed behind. Propodeum in greater part finely rugose in female, more coarsely so in male; with area externa finely or rather finely punctate and conspicuously shining, and area pleuralis moderately and closely punctate; with costae including costulae sharp and of moderate strength: area superomedia distinctly longer than broad, emitting costulae about in middle, not or not strongly delimited basally.

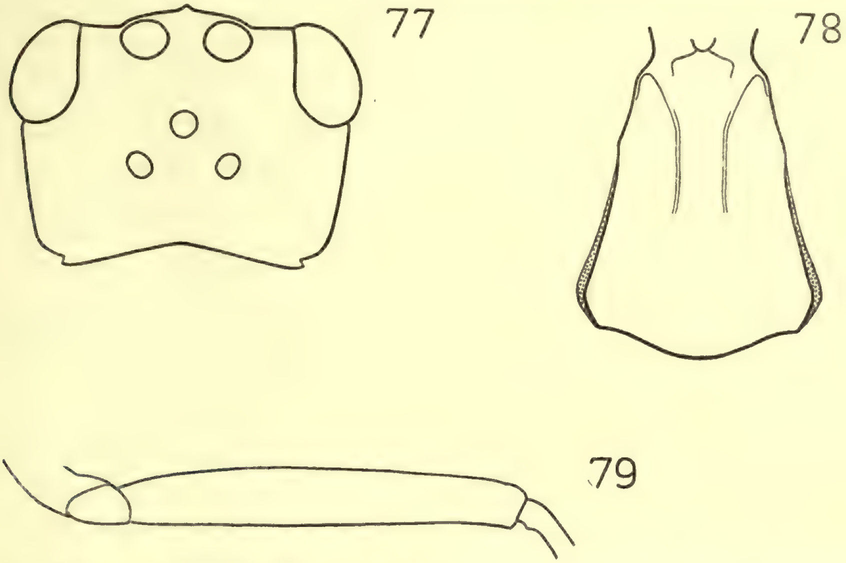
Petiolar segment (Fig. 78) 1·4 to 1·5 times length of its greatest breadth in female, 1·5 to 1·7 times in male, unusually elongate and regularly explanate for this genus; with basal lobes weak or scarcely apparent; laterally weakly margined in female, more strongly so in male; with dorsal keels in female weak, distinct for about half length of segment, longer and stronger in male; dorsally coriaceo-rugose, smooth at mid apex. Remainder of gaster shining: tergite 2 with diagonal basal furrows no more than moderately impressed, moderately and closely though shallowly punctate between them: gaster more and more finely punctate towards apex. Female hypopygium bent at a definitely obtuse angle, and sharply keeled mid-ventrally beyond the bend (cf. *pallitarsis* Thoms. in which it is bent at about a right angle and is not thence sharply keeled). Female third valvulae of the same general type as in *pallitarsis* Thoms., but more elongate, less broad, and less excavate beneath.

Fore wings with basal and disco-cubital veins not nearly parallel: with areolet always distinctly petiolate; with nervus parallelus emitted well below middle of brachial cell: radial cell 2·6 to 2·9 times length of its greatest breadth. Hind wings with nervellus antefurcal and intercepted far below middle.

Legs elongate and slender; notably the hind femora (Fig. 79), which are much more so than in *pallitarsis* Thoms.: the males, however, less characteristic in this respect. Tarsal claws regularly and rather strongly pectinate in female, but with much shorter comb-teeth in male.

Length 6 to 10 mm.

Female. Head black, with the following parts pale, bright flavous: mandibles except at apex, clypeus, lower face except for a median mark in upper part, and genae very broadly, the pale colour crossing the hypostomal costa: palpi more fulvous. The pale colour does not extend up the inner orbits above the top of the antennal sockets: the region of the clypeo-frontal suture is more or less distinctly dark-marked between the tentorial pits. Antennae ferrugineous, merging to black at base above, paler below; with scape pale, bright flavous below; with pedicellus similar, or usually at least conspicuously pale below. Thorax and propodeum black, with the following bright flavous: lower angle of pronotum and margin some way forward thereof, humeral angle and margin well forward thereof, propleura, marks below fore and hind wings, rather small mid apical marks of scutellum and metascutellum, and lateral flanges of scutellum: tegulae stramineous, scarcely suffused flavous: mesosternum not pale-marked. Legs rufous, notably the hind tibiae, which are not at all blackened, or only very weakly so at extreme apex; with fore and mid femora and fore tibiae paler in front and hind trochanters below: fore and mid coxae, trochanters and trochanterelli flavous; with those of mid leg extensively, and fore coxae on outer side, rufous-marked: tarsi somewhat darkened at apex. Wing veins pale ferrugineous; with axillary sclerites pale flavous: stigma pale ochreous. Gaster black above, with sides and venter flavous: tergites with pale flavous triangular marks at mid apex, increasing in size from 1 to 5; and usually with very fine pale hind margins: third valvulae darkened at apex.



FIGS. 77–79. *Eudiaborus boreoalpinus* sp.n. Fig. 77. Head from above. The head is tilted farther backward than in corresponding figures of species of other genera, otherwise the hind emargination would appear deeper. Fig. 78. Petiolar segment. Fig. 79. Left hind femur in sinistro-lateral view.

Male differs as follows. Pale coloration distinctly not reaching level of top of antennal sockets, and on gena much more restricted, not nearly reaching hypostomal costa: lower face with a broad, median black band: clypeus broadly black basally between tentorial pits. Thorax with tegulae and upper margin of pronotum coloured as in female, but other pale markings absent or much reduced: in particular, the scutellum is not pale-marked at mid apex except obscurely in one specimen, and the propleura are black. Legs with coxae, trochanters and trochanterelli blackish in place of rufous, and rather more extensively so, the fore trochanters blackish-marked above: mid and hind femora sometimes blackish below near base: hind tibiae at apex usually, and hind tarsi always, extensively darkened. Pterostigma sometimes darker. Triangular pale marks sometimes undeveloped on tergites 1 and 2: venter blackish in part.

Described from the following material. SCOTLAND, Inverness-shire, Cairngorm Mts., 3,000 ft., 1 ♀, 18.viii.1925, F. C. Best (type): SWEDEN, Jemtland, 1 ♀; Lapland, 1 ♀, 25.vii, C. Boheman: SWITZERLAND, Engadine National Park, Il Fuorn, La Drosa, 1 ♀, 10.viii.1921, Ch. Ferrière: AUSTRIA, Styria, Kreuzkogel southern slope, 1,800 m., 1 ♂, 7.viii.1950; Niedere Tauern, 2,000 m., 1 ♀, 21.viii.1950, G. Heinrich: GERMANY, Bavaria, Allgäu, Osterachtal, 1,600 m., 2 ♂♂, 1 ♀, 8.viii.1949, G. Heinrich; Silesia, Glatzer Schneeberg, 1 ♂, 2.viii, 1 ♀, 11.viii.1921, K. Hedwig (recorded as *nigrifrons* Thoms. var. *pallitarsis* Thoms. as determined by A. Roman, Hedwig 1940).

Holotype ♀ in British Museum (Natural History).

In the female sex, this species is very distinctive in the long, almost straight-sided head; the ventrally almost straight, scarcely incised epicnemial carina; the shape of the petiolar segment; the long, slender hind legs with slender femora and clear red tibiae, which are not blackened or scarcely so at extreme apex; and the black mesosternum. The male is more weakly characterized.

This species is of particular interest on account of the distribution, which is of the wide Arctic type (Benson, 1950: 93, 95).

Further material seen: see supplement, p. 454 below.

Genus *CTENISCUS* (Haliday MSS.), Curtis, Thomson

1832 *Tryphon*, subgenus *Cteniscus* (Haliday MSS.) Curtis, *British Entomology*, **9:** 399.
1838 *Tryphon*, subgenus *Cteniscus* Haliday, *Ann. Mag. nat. Hist.* (1) **2:** 113.
1883 *Cteniscus* Thomson, *Opuscula Entomologica*, fasc. 9: 881–882.

I began my work on this genus with a study of the two Haliday species that had been proposed as genotypes. It was soon found necessary, not only to redescribe *curtisii* Hal., which has been very little understood, but also to distinguish it more critically from the species most closely allied to it. This work was then extended to become a revision of most of the European 'black-bodied' species of the genus.

Among the red-bodied species, Roman (1913, 1931) has pronounced a number of the forms, described as species by Holmgren and others, to be no more than races or mere colour varieties of *flavomaculatus* Grav. This synonymy, which has been largely followed by the present and other authors, was, however, carried too far. Thus, the majority of forms have the head rather strongly punctate and not narrowed behind the eyes, whereas *pumilus* Hlgr. and *limbatellus* Hlgr. have the head very finely punctate and shining, distinctly narrowed behind the eyes. Other good structural differences may be found, to separate forms at present distinguished only by colour characters. A. Roman rearranged the collection of Swedish Ichneumonidae in the Stockholm museum, but he did not omit to select lectotypes of the forms described by Holmgren.

Ctenicus hofferi Gregor

1858 *Exenterus succinctus* Holmgren, *Svensk Vet.-Akad. Handl.* **1**: 230 (*non* Gravenhorst 1829).
1914 *Ctenicus gnathoxanthus* var. Roman, *Ark. Zool.* **9** (2): 16 (*non* Gravenhorst 1829).
1937 *Ctenicus hofferi* Gregor, *Festschrift E. Strand, Riga,* **2**: 416–417.

Head moderately narrowed and scarcely rounded behind eyes; rather deeply and almost angularly emarginate behind: shining, with vertical region and temples moderately, and cheeks generally finely punctate; lower face more coarsely, and upper face medially also more densely so, obsoletely alutaceous. Clypeus sparsely punctate; rather narrowly rounded apically; rather deeply delimited, with tentorial pits conspicuous; strongly convex in basal and shallowly impressed in apical half: in male it is generally more evenly convex, and very shallowly impressed before the projecting apex. Malar space shorter, in male much shorter, than distance between mandibular apices. Hypostomal costa slightly raised to where it is met by genal costa, at a strongly acute angle a good way behind mandibular base. Upper mandibular tooth longer than lower.

Antennae with scape rather short, moderately excised externo-ventrally: flagellum normally 27- to 31-, but in Holmgren's small northern specimen only 22- segmented, tapering gradually to apex.

Pronotum with dorsal transverse furrow narrow and sharply impressed; with epomiae usually weak; shining and moderately punctate above, more or less longitudinally rugose below. Propleura shining and moderately punctate, anteriorly strongly rugose. Mesoscutum rising sharply from pronotum, rather strongly convex; with notaulices short but strongly impressed, giving it a distinctly trilobed appearance; discally often rather coarsely punctate, peripherally more finely so; between notaulices generally very weakly rugose. Scutellum generally rather strongly convex; sparsely punctate; margined scarcely beyond scutellar fovea. Mesopleura closely and rather strongly punctate, much more sparsely so above; with a shining speculum: sternaulices very superficial: mesosternum towards mid line more sparsely and irregularly, almost rugose-punctate, smooth and shining behind: prepectus strongly punctate: epicnemial carina very slightly elevated: mesolcus moderately impressed, narrow anteriorly and widened posteriorly, scarcely closed by the transverse rugosities behind. Metascutellum smooth and rather prominent. Propodeum shining and very weakly punctate above, with the area pleuralis much more clearly and densely punctate; with costae including costulae moderately strong, in male strong and sharp: area basalis not delimited apically: area superomedia usually longer than broad, emitting costulae before middle.

Gaster stoutly spindle-shaped in female, behind petiolar segment almost parallel-sided in male: petiolar segment very obscurely rugose, but with distinct longitudinal rugosities by apical angles and smooth and very shining in mid third of hind margin: remaining segments smooth and shining. Petiolar segment 1·0 to 1·3 times length of its greatest breadth in female, 1·3 to 1·7 times in male: rather broad at the base, but without basal lobes; moderately explanate and strongly margined; with keels distinct for more than half length of segment, stronger and more nearly percurrent in male; with furrows between keels and margins more or less developed; with a strong lateral furrow leading to the glymma: spiracles situated well before middle, not prominent. Tergite 2 with thyridia distinct but narrow in female, broader and more conspicuous in male; with diagonal basal impressions distinct in male, but superficial and ill-defined. Female hypopygium almost pointed apically: third valvulae normally not nearly reaching apex of tergite 8.

Fore wings with basal and disco-cubital veins not nearly parallel; with areolet very broad and shortly petiolate; with nervus parallelus emitted in middle of brachial cell. Hind wings with nervellus strongly antefurcal and intercepted far below middle.

Legs with the black hind tibiae relatively thick (Fig. 81). Claws of all tarsi strongly pectinate.

Length 7 to 11½ mm.

Female. Head black, with the following parts ivory to pale flavous: genae except near costa, lower face except for a median mark in upper part, whole of clypeus, often a small orbital spot just below level of median ocellus, and most of mouth-parts except mandibular apices. Antennae ferrugineous; basally darker, especially above. Thorax and propodeum black, with the following parts stramineous to bright flavous margined with fulvous: humeral angle of pronotum and upper margin some distance forward thereof, whole of its lower margin at sides and a median anterior mark (these two sometimes continuous), propleura except anteriorly and near mid line, tegulae, line below fore wings, generally two pairs of small marks on prepectus, another before bases of mid coxae, large quadrangular apical mark and lateral extensions of scutellum, mark below hind wings extending down hind margin of mesopleura, and metascutellum. Legs with fore and mid coxae, trochanters and trochanterelli stramineous to flavous, suffused fulvous: fore and mid tibiae and tarsi, all femora, and hind coxae and trochanters fulvous: hind tibiae and tarsal segments almost black, fulvous at base, and often paler beneath; hind tibiae with a pale sub-basal mark. Wings slightly infumate, with veins and stigma fuscous to ferrugineous, the veins basally flavous and the stigma basally luteous. Gaster black above, the tergites having pale apical and lateral margins; stramineous to fulvous below, with black marks on some sternites, but hypopygium pale: thyridia castaneous.

Male differs from the female as follows. Head with the pale parts more whitish stramineous, but with the clypeus in apical half generally suffused fulvous. Antennae deep ferrugineous, almost black; scape pale flavous beneath, pedicellus and annellus pale beneath, postannellus pale at base and apex and next few segments at apex. Lower margin of pronotum forming a complete pale collar. Hind coxae and trochanters paler. Pale margins of tergites 1–3 triangularly broadened.

Redescribed from the following material: IRELAND, Co. Waterford, Dungarvan, Maghgiha, 1 ♀, 17.viii.1928; Co. West Mayo, Old Head, wood, at larva of *Croesus* on *Betula*; Co. Wicklow, Glending Wood, 1 ♀, 15.ix.1938; Leitrim Barracks (Glen of Imaal), 1 ♂, 11.viii.1940; Co. Dublin, Slade Brook, *ex* larva of *Hemichroa crocea* Geoffr. (larva 21.ix.1941), 1 ♂ em. 6.viii.1942, A. W. Stelfox: ENGLAND, unlocalized, 1 ♂ (under *curtisii* Hal.), T. Desvignes coll.: BELGIUM, unlocalized, 1 ♂, 5 ♀♀, C. Wesmael; Sichem, 3 ♀♀, 14–15.ix.1886; Verrewinkel, 1 ♂, 15.ix.1848; Sysseele, 1 ♀, 22.ix.1876; Carlsbourg, 1 ♀, 9.ix.1898; Severin, 1 ♀, 28.ix.1897, J. Tosquinet: SWEDEN, Skåne, Skäralid, 1 ♂, 4.ix.1938, G. J. K.; Västerbotten, Tavelsjö, 1 ♀, 4.ix, C. Boheman (recorded as *succinctus* Grav., Holmgren 1858): FINLAND, Lojo, 1 ♀, 1934, R. Krogerus, 1 ♀, W. Hellén; Karislojo, 1 ♀, R. Forsius: GERMANY, unlocalized, 1 ♀, Ruthe coll. (under *Tryphon sexlituratus* Grav.); Göttingen, 1 ♀, 13.ix.1946; Hannover, 1 ♀, 13.ix.1948, R. Hinz: AUSTRIA, Pettenbach (S. of Wels), 1 ♀, 7.x.1941, Czerny: ITALY, Piedmont, 2 ♀♀, 1859, O. Sichel.

Additional material seen: HOLLAND, Brummen, 3 ♀♀, vii, round *Nematus* larvae on *Sorbus aucuparia*, Snellen van Vollenhoven (1872: 167, recorded as *Exenterus succinctus* Grav.).

Roman (1914) interpreted the unique female in the Holmgren collection as an extraordinarily white variety of *Ct. gnathoxanthus* Grav. In later years he arranged it in the Swedish collection of the Stockholm museum under *breviventris* Thoms., which species is, however, placed otherwise in the present paper (p. 437).

Since going to press I have, through the kindness of Dr. Z. Bouček, received the type of *hofferi* Greg. on loan. I had no real doubt that the species was correctly identified, but there were certain discrepancies in an otherwise good original description. It has been my frequent experience that subsequent micrometer measurement belies an estimate of the length to breadth of a structure made by eye; and the same difficulty must affect other authors, for in this specimen the length to greatest breadth of both area superomedia and petiolar segment are 1: 1·3 to the nearest 0·1. As suspected, 'Weiss sind . . . Hüften und Trochanteren II. und III.' was a *lapsus* for ' . . . I. und II.' The head of the type had been lost, but the thorax and abdomen and their appendages conform to my description and agree closely with specimens from which it was made.

Biology. As recorded above, A. W. Stelfox took a parasitized larva of *Hemichroa crocea* Geoffr. on 21 September 1941, and bred an adult male parasite, which emerged in early August the following year. He also found the adult female parasite investigating *Croesus* larvae on birch.

R. Hinz took an adult female on 13 September 1948, and sustained it with sugar water. It attacked a larva of *Arge ustulata* L. but laid no egg. It attacked a larva of *Hemichroa crocea* Geoffr., and so wounded it that body fluid oozed out, but again no egg was laid. When presented with larvae of *Croesus septentrionalis* L. and *latipes* Vill., it oviposited on them without further ado on the writing-table. The main breeding experiments were carried out, however, with three species of *Nematus*.

The procedure prior to oviposition was observed as follows: the ovipositor is bent free from the sheaths, and the egg is pushed to the tip of it, while pulsating movements of the abdomen take place; the ovipositor then resumes the resting position, and the insect is prepared for oviposition. The egg has no real stalk, but a crochet apparatus; and is affixed between the first and second or second and third body segments of the host. Eggs were laid at intervals of about 10 minutes, sometimes longer. Thus on 19th September 1948, 8 eggs were laid between 11 a.m. and 12.15; while on the 15th, 10 eggs were laid altogether.

Eggs were obtained on 25 larvae of *Nematus* (*Pteronidea*) *pavidus* Lep., on 16 of *N.* (*Pt.*) *miliaris* Panz., and on 11 of *N.* (*Pt.*) *melanocephalus* Hart. The larvae hid away in preserving tins containing some sand. From the *pavidus* larvae, 24 cocoons were obtained; but these were only found to contain remains of the host larvae. The same kind of result was obtained with the *miliaris*. By contrast, the batch of *melanocephalus* gave 10 cocoons; and from these there were hatched in due season 2 adult females of the sawfly and 8 adult males of the *Cteniscus*. Considering the difficulty of obtaining the right conditions for rearing sawfly larvae, Herr Hinz does not wish to base any facile conclusions on these results; but he observes that the *melanocephalus* is the largest larva of the three *Nematus* species used.

Ctenìscus lineiger Thomson

1858 *Exenterus exstirpatorius* Holmgren, *Svensk Vet.-Akad. Handl.* **1:** 238 (*non* Gravenhorst 1829).

1883 *Ctenìscus lineiger* Thomson, *Opuscula Entomologica*, fasc. 9: 894.

Head moderately narrowed and rounded behind eyes; about as long behind eyes as eye length, seen from above, in female, shorter in male; shallowly emarginate behind: on vertical region, temples and upper face moderately and rather densely punctate; on sides of lower face less densely so, and on genae broadly much more finely and sparsely punctate: epistoma rather coarsely punctate, obsoletely alutaceous. Clypeus somewhat closely beset, mostly with moderate punctures, closely alutaceous near mid apex; sharply delimited basally; moderately convex in basal and broadly and shallowly impressed in apical half; moderately rounded at apex. Malar space about three-quarters distance between mandibular apices. Hypostomal costa very slightly and evenly raised: sides of proboscideal fossa bent strongly outwards.

Antennae with basal segments very much as in *Ct. gnathoxanthus* Grav. (see description, p. 441 and Fig. 83): flagellum 24- to 27-segmented.

Pronotum with dorsal transverse furrow moderately impressed, coarsely transcarinate; with epomiae sharp but short; laterally moderately punctate above, extensively longitudinally rugose below. Propleura moderately and closely punctate. Mesoscutum rising sharply from pronotum, strongly convex; with notaulices rather short, moderately impressed; for the most part shining and finely to moderately punctate, but between notaulices closely punctate and obsoletely rugose. Scutellum weakly convex, and to some extent buckled discally; not margined much beyond scutellar fovea; very finely punctate at sides and behind, almost impunctate discally. Mesopleura rather coarsely and closely punctate below, but shining between the punctures, not much more finely punctate above, and with a small, shining speculum: sternaulices moderately and rather sharply impressed: mesosternum rather finely to moderately and closely punctate, prepectus strongly so: epicnemial carina slightly but distinctly elevated: mesolcus sharply impressed and narrow, broadened posteriorly, partly closed behind. Propodeum very finely punctate and shining, in part obsoletely rugose, with area pleuralis not much less finely punctate in greater part, distinctly rugose below; with costae sharp and of moderate strength: area posteromedia with a percurrent median keel: area superomedia distinctly broader than long, distinctly delimited basally.

Gaster stoutly spindle-shaped in female, behind petiolar segment almost parallel-sided in male: petiolar segment in greater part distinctly though usually weakly rugose, smooth to a greater or lesser extent near mid apex: tergite 2 coriaceous at base between thyridia: remainder of gaster smooth and shining. Petiolar segment 1·1 to 1·3 times length of its greatest breadth in female, 1·3 to 1·5 times in male; rather strongly explanate and strongly margined; without basal lobes, but with spiracular tubercles rather prominent; with dorsal keels distinct for rather more than half length of segment, and with a distinct median pit just behind them. Tergite 2 with thyridia narrow and inconspicuous in female, broader in male but less so than in male of *hofferi* Greg. Female hypopygium blunt-pointed at apex: third valvulae rather small, but stout and densely hairy, extending a little beyond apex of tergite 8.

Fore wings with basal and disco-cubital veins more nearly parallel than in *hofferi* Greg., and both more nearly vertical; with areolet broad and shortly petiolate; with nervus parallelus emitted below middle of brachial cell: stigma and radial cell relatively broad, the latter 2·2 to 2·6 times length of its greatest breadth (in *hofferi* 2·6 to 3·0 times). Hind wings with nervellus antefurcal, intercepted well below middle.

Legs relatively stout, stouter than in *rufonotatus* Hlgr., but not so strongly expanded in apical quarter as in *hofferi* Greg. Tarsal claws with pectination of moderate strength, not extending to apex.

Length 6 to 8 mm.

Head coloured as in *hofferi* Greg., but lower face with a complete median black band, and genae not pale to so near costa. Antennae with scape and pedicellus blackish above, paler at apex, flavous marked below in female and more distinctly so in male; with annellus and extreme base of postannellus more or less pale; beyond that ferrugineous above, paler below. Thorax and propodeum black, with the following parts stramineous to bright flavous: pronotum as described for *hofferi* Greg., large quadrangular apical mark and lateral extensions of scutellum and metascutellum, tegulae, and marks below fore and hind wings: propleura usually only obscurely pale on hind margin, never in greater part. Legs with fore and mid coxae, and all trochanters and trochanterelli, mainly stramineous to pale flavous; with hind coxae blackish at base, especially above: fore and mid femora, tibiae and tarsi pale rufous, the femora flavescent towards apex: hind legs with femora rufous and tibiae and tarsi dull rufous, the tibiae broadly towards apex and tarsi largely infuscate; sometimes with femora at apex and tibiae a little distance from base obscurely infuscate. Wings with veins and stigma ferrugineous, pale at base. Gaster with petiolar segment black in about basal two-thirds and at hinder angles, sometimes more extensively; with remainder of tergite 1, tergites 2 to 4 mainly, and sometimes 5 at mid base or more extensively, rufous; with remainder of dorsum and with third valvulae blackish, but tergites 2 to 3 or 4 with rather obscure flavous hind margins, and remaining tergites margined ivory-white: female hypopygium blackish, sometimes partly rufescent, narrowly pale-margined: male with last three visible sternites similar, the first of these more broadly pale-margined.

Described from the following material: BELGIUM, unlocalized, 1 ♀, C. Wesmael: FINLAND, province Nyland (Uusimaa), Pernå, 1 ♂, 3 ♀♀, Å. Nordström; Pargas, 1 ♀, E. Reuter. Further material seen: SWEDEN, unlocalized, 2 ♂♂, coll. Ljung (Thomson coll.); Östergötland, Mjölsefall, 1 ♂, 5.viii (type); Åby, 1 ♂, A. v. Goës. These males are darker on gaster than as above described. Thomson's female specimen from Pålsjo is missing.

Ct. lineiger var. **nordströmi** var. n.

Differs from the type form in having the gaster not largely rufous but black, apart from the pale hind margins: tergites 2 and 3 have hind margins of a duller colour yet more conspicuous against the black background, and tergite 1 is obscurely pale-margined at apex: thyridia castaneous.

Described from the following material: FINLAND, Pernå, 3 ♂♂, 1 ♀ (type), Å. Nordström.

Recorded dates of capture of type form and variety range from 13.vii to 23.viii.

W. Hellén first sent two males of the black-bodied form of this species for my opinion. I told him I believed the species to be new, and that I would place it nearest to *hofferi* Greg., and gave him the main differences I found from that species.

Later he wrote me that he had since associated the female sex with the male, and also a red-bodied form of the species with the black-bodied. He added that the captor, Lektor Å. Nordström, wished to present me with specimens, and that he himself would like me to describe the species in the course of my paper.

However, I placed the red-bodied form tentatively as *exstirpatorius* Hlgr. *non* Grav.; and in 1952 I was able to confirm this by comparison with the type in Stockholm and with two specimens in Thomson's collection. But to Dr. Hellén belongs the credit for being, as I believe, the first to associate real red- and black-bodied forms of a European species of *Ctenisсus*. The black-bodied form has been captured exclusively by Lektor Nordström, and I have pleasure in naming this seemingly distinct variety after him.

Cteniscus curtisii Haliday

1838 *Tryphon* (subgenus *Cteniscus*) *curtisii* Haliday, *Ann. Mag. nat. Hist.* (1) **2:** 113.
1855 *Exenterus sexcinctus* Holmgren, *Svensk Vet.-Akad. Handl.*, **1:** 229–230 (*non* Gravenhorst 1829).
1871 ? *Cteniscus sexcinctus* Brischke, *Schrift. Phys.-ökon. Ges. Königsberg*, **11:** 97.
1878 ? *Cteniscus sexcinctus* Brischke, *Schrift. naturf. Ges. Danzig*, **4:** 104 (= *sexcinctus* var. 1, Schmiedeknecht 1911: 2288).
1913 *Cteniscus curtisii* Roman, *Ent. Tidskr.* **32:** 129.
1929 *Cteniscus curtisii* Gregor, *Zpravy čsk. Stát. Real. Gymn. Nové Jičín*, **1929:** 4–5 (separate pagination).

Head somewhat strongly narrowed and, in larger specimens, scarcely rounded behind the eyes; moderately and rather evenly emarginate behind; distinctly shorter behind eye than eye length, seen from above: shining, with vertical region and temples for the most part finely punctate, but near occiput and on cheeks less finely so; upper face moderately and lower face rather coarsely punctate. Clypeus more or less coarsely, rather shallowly and sparsely punctate; deeply delimited; generally somewhat broadly rounded apically; strongly convex in basal and more or less impressed in apical half. Malar space in female about three-quarters and in male about one-half distance between mandibular apices. Hypostomal costa slightly raised to beyond junction with genal costa, which is not very far behind mandibular base: gena with a slight concavity outside this junction. Upper mandibular tooth slightly longer than lower.

Antennae with scape short, somewhat strongly convex dorsally and moderately excised externo-ventrally; with post-annellus 1·4 to 1·5 times length of following segment: flagellum 27- to 32-segmented (32 in type), slightly expanded in middle.

Pronotum with dorsal transverse impression sharp, transcostate; with epomiae rather strong above; shining and rather finely punctate above, merging to transversely rugose below. Propleura moderately and rather closely punctate, anteriorly finely rugose. Mesoscutum moderately convex; with notaulices strongly and sharply impressed; closely and for the most part moderately to rather coarsely punctate. Scutellum not strongly convex, often rather flattened discally; sparsely punctate above and on sides, more closely so behind; with margins not sharp much beyond scutellar fovea. Mesopleura rather closely and coarsely punctate below, more finely and much more sparsely so above; sternaulices broad and rather superficial but quite distinct: mesosternum moderately and somewhat closely punctate in front, more finely and sparsely so behind: prepectus closely and rather strongly punctate: epicnemial carina slightly elevated: mesolcus moderately impressed and parallel-sided for the greater part of its length, suddenly enlarged before the transverse costa which partly closes it behind. Metascutellum smooth, normally raised. Propodeum relatively strongly griseo-pilose and closely, finely to moderately punctate, with the area pleuralis most distinctly punctate; shining, but with some areas having obsolete rugulosity, the area posteromedia very distinctly rugulose; with costae rather strong but costulae weaker, sometimes incomplete: area superomedia emitting costulae behind middle, broadest at that point; relatively broad, with the almost straight sides converging strongly from costulae to base; basally delimited.

Gaster stoutly spindle-shaped in female, very much less rounded in male: petiolar segment, except near apex, coriaceous, or in part weakly rugose: gaster otherwise smooth and shining. Petiolar segment of female broad, its breadth being approximately as great as its length (39: 39 in type, tending to be less in smaller and greater in larger specimens); of male 1·2 to 1·3 times length of its greatest breadth; with sides almost evenly rounded and not very strongly margined in female, the spiracles not prominent; with keels distinct to middle, to which it is strongly raised. Tergite 2 with thyridia rather narrow in female, broad and conspicuous in male; with diagonal basal impressions discernible. Female hypopygium pointed apically: third valvulae extending distinctly beyond apex of tergite 8.

Fore wings with basal and disco-cubital veins not nearly parallel; with areolet shortly or scarcely petiolate, not very broad, its outer vein almost interstitial with the second recurrent; with nervus parallelus emitted distinctly a little below middle of brachial cell. Hind wings with nervellus antefurcal and intercepted rather far below middle.

Legs with the hind tibiae and tarsi very thick, thicker than in *hofferi* Greg. (Fig. 81), the hind metatarsus in inner side view about 5½ times length of its greatest breadth. Claws of all tarsi strongly pectinate, but more sparsely so in male.

Length 6½ to 9 mm.

Head black, with the following parts bright stramineous, margined with rufous: mandibles except at apex, clypeus except narrowly round base, and broad lateral marks on the lower face extending through full width of the malar space down to the genae: these marks extend on the genae from eye margin about half-way to costa;

and they leave the lower face black rather broadly below antennae to eye margin, broadly down mid line, and, usually narrowly, along clypeo-frontal suture. Palpi stramineous to rufous. Antennae dull ferrugineous, with basal segments usually almost black except at their apices: sometimes rather paler. Thorax and propodeum black, with the following parts bright flavous: humeral angle and mark in lower angle of pronotum, a mark below hind wings, and quadrangular apical marks and hind margins of scutellum and metascutellum: tegulae usually mostly rufous, sometimes flavous. Legs red; with fore and mid legs in part, especially on trochanterelli, tending to dull flavous; with hind tibiae and tarsi black, the tibiae with some infusion of reddish colour, especially beneath and in smaller specimens, distinctly stramineous at base and indistinctly fulvous at extreme base. Wings slightly infumate, with veins and stigma ferrugineous, much paler at base. Gaster black above, the tergites having pale apical margins narrow or very narrow: sternites usually mainly black, the female hypopygium black with narrow pale margin: thyridia castaneous.

Redescribed from the following material: IRELAND, 1 ♀, Haliday coll. (type): Co. Wicklow, Meeting of the Waters below Rathdrum, 1 ♀, 6. viii. 1925, A. W. Stelfox: ENGLAND, 1 ♀, Desvignes coll. (previously undetermined), 1 ♀, Smith coll.; Surrey, Oxshott, 1 ♀, 6.vii.1892, Melville-Bury coll. (Manchester Museum); Essex, Colchester, 2 ♀♀, 1903, 1914, Harwood; Lancs. S., Chat Moss, 1 ♀, 21.ix.1941, H. Britten: FRANCE, 1 ♀ (probably France), de Gaulle; Corrèze, Bort-les-Orgues, 1 ♀, 15–23.vi.1934, M. E. Mosely: ITALY, Piedmont, 1 ♀, 1859, O. Sichel: BELGIUM, Vivier d'Oie, 1 ♂, 27.v.1889, 1 ♀, 4.viii.1880: Hestreux, 2 ♀♀, 5–9.viii.1884; Liège, 2 ♀♀, 1862, coll. J. Tosquinet: HOLLAND, N. Brabant, Burgst, 1 ♂, vi.1913, Smits van Burgst: GERMANY, Hamburg, Trittau, 1 ♀, 7.vii.1945, G. Heinrich: CZECHOSLOVAKIA, Chodau, 2 ♀♀, R. von Stein coll.; Ubučin, 1 ♀, 7.viii.1924, Fr. Gregor: FINLAND, Parikkala, 1 ♀, W. Hellén.

Additional material seen: SWEDEN, Skåne, Pålsjö, 1 ♂; 1 ♀ without data, Thomson coll.; 1 ♀ province Darlarne, 1 ♀ Lapland, Boheman: POLAND, Pomorzia, Sepolno, 1 ♀ 25.viii.1939, G. Heinrich.

This species has been very little understood since its description, partly owing, no doubt, to its apparent scarcity. It is hoped that the characters now given in the key to species will suffice to separate it from its nearest relatives. As shown by Roman (1913), it was misidentified by Holmgren as *sexcinctus* Grav., and it has stood under that name in the Tosquinet and other collections. Characters given by Gregor (1929) have been unavailable to those ignorant of the Czech language: having received a translation of this paper, I am able to render the passage in question in the following words: 'abdomen black, with thin pale borders to the segments. Scutellum and metascutellum posteriorly yellow-marked, with a white border going to the wings. Mandibles with teeth of equal length (in contradistinction to *Acrotomus sexcinctus* and *succinctus*). The face has two white trapezium-shaped spots touching the eyes and connected with the white genae. Hypopygium black. Hind tarsi and tibiae (except at base) black. Abdomen shining, finely punctate.' The species placed as *curtisii* in the Desvignes collection is a male of *hofferi* Gregor (q.v.).

Biology. Since the above was written, I have seen a specimen reared from *Hemichroa australis* Lep. (= *alni* auctt. *non* L.): ENGLAND, Beds., Flitwick Moor, 1 ♀ *ex* larva taken 13.vii.1947 on *Betula*, em. 26.viii.1947, V. H. Chambers. As indicated in the synonymic table, it is most probably this species, recorded as *Cteniscus sexcinctus*, that was reared from '*Dineura alni*' by Brischke (1871, 1878).

Cteniscus romani sp. n.

1871 ? *Cteniscus sexcinctus* var. Brischke, *Schrift. Phys.-ökon. Ges. Königsberg*, **11:** 97 (*non* Gravenhorst 1829).

1878 ? *Cteniscus sexcinctus* var. Brischke, *Schrift. naturf. Ges. Danzig*, **4:** 104 (= *sexcinctus* var. 2 Schmiedeknecht 1911: 2288).

1948 *Cteniscus curtisi* var. Teunissen, *Tijds. Ent.* **89:** 13 (*non* Haliday 1838).

Head moderately to strongly narrowed behind eyes, moderately or rather shallowly emarginate behind; about as long behind eyes as eye length, seen from above: punctate on vertical region, temples and cheeks as described for *curtisii* Hal.; on upper face rather finely and on lower face moderately, sometimes in middle rather coarsely punctate, on both much more sparsely so than in *curtisii* Hal., and with an impunctate area above each antennal socket. Clypeus rather sparsely beset with punctures of mixed sizes, fine to rather coarse; deeply delimited basally; moderately convex in basal half, and somewhat impressed before the rather narrowly to moderately rounded apex. Malar space nearly three-quarters distance between mandibular apices in female, about half such distance in male. Hypostomal costa very slightly raised, bent distinctly outwards; its junction with genal costa farther behind mandibular base than in *curtisii* Hal.

Antennae with scape rather short, and with a sharp lateral excision (Fig. 84); with postannellus about 1·4 times length of following segment in female, about 1·3 times in male: flagellum 28- to 33-segmented.

Thorax and propodeum structure differing from that described for *curtisii* Hal. as follows: pronotum narrower before dorsal impression: propleura rather sparsely punctate: mesoscutum less coarsely and closely punctate: mesopleura rather finely to moderately and sparsely punctate below, finely so above: sternaulices rather weakly impressed: mesosternum less closely punctate: prepectus moderately and, except at sides, sparsely punctate, more excavate than in *curtisii* Hal.: propodeum having area externa more finely and area pleuralis more distinctly punctate; area posteromedia smoother; costulae indicated but seldom developed, emitted from about middle of area superomedia, which is relatively narrow, distinctly longer than broad, with sides somewhat rounded and not strongly converging, and not basally delimited.

Gaster stoutly spindle-shaped in female, behind petiolar segment almost straight-sided in male, its structure differing from that described for *curtisii* Hal. as follows: petiolar segment mainly smooth, but to some extent obscurely rugose at sides; a little longer, 1·1 to 1·3 times length of its greatest breadth in female, 1·1 to 1·4 times in male; more strongly narrowed to base; more strongly raised to middle, having dorsal keels distinct not nearly to middle: basal diagonal impressions of tergite 2 more evident: female hypopygium less pointed, and third valvulae projecting scarcely beyond apex of tergite 8.

Structure of legs and fore wings as described for *curtisii* Hal.: hind wings with nervellus strongly antefurcal and intercepted very low.

Length 6½ to 10 mm.

Head coloured as in *curtisii* Hal., but pale, bright flavous in place of stramineous, and a little more extensively pale on genae: palpi also mainly flavous. Female antennae with scape, pedicellus, and annellus black to ferrugineous, paler at apex and beneath; beyond annellus pale rufous, darkened in about apical half: male antennae much duller. Thorax differs from *curtisii* Hal. in having scutellum and metascutellum without conspicuous quadrangular pale marks at mid apex: scutellum obscurely dull red at mid apex, bright flavous only at sides of hind margin, where metascutellum is obscurely pale: tegulae scarcely rufous: fore and hind margins of mesopleuron and sub-tegular mark often dull castaneous. Legs as described for *curtisii* Hal. but fore and mid legs more yellowed, especially in front; hind femora often for the most part much darkened, and hind tarsi often infused reddish. Wing colour as described for *curtisii* Hal. Pale margins of tergites 6 and 7 and of female hypopygium rather broader than in *curtisii* Hal.

Described from the following material: IRELAND, Co. Dublin, Slade of Saggart, 1 ♀, 16.ix.1942; Co. Wicklow, Deputy's Pass, 1 ♂, 11.ix.1932, A. W. Stelfox: FRANCE, Ardennes, Vendresse, 1 ♂, 30.ix.1912, R. Benoist: BELGIUM, unlocalized, 5 ♀♀, coll. Wesmael; Vivier d'Oie, 1 ♀, 9.x.1883, J. Tosquinet (type): HOLLAND, Tilburg, 1 ♀, 16.ix.1941, H. G. M. Teunissen (Teunissen 1948): GERMANY, Radbruch, 1 ♀, 25.ix. 1938, R. Hinz; Holstein, Trittau, Hahnheide, 2 ♂♂, 2 ♀♀, ix.1945, G. Heinrich: SWEDEN, Småland, Lommaryd, 1 ♂, 31.viii, 1 ♀, 12.ix. (mus. Stockholm, ? year and collector): FINLAND, Säkylä Kolva, 1 ♀, W. Hellén; Lojo, 1 ♂, 1938, R. Krogerus.

Dedicated with respect and gratitude to the late Dr. A. Roman.

Cteniscus elegans Stephens

1835 *Tryphon elegans* Stephens, *Illustrations of British Entomology*, **7**: 239.

1871 ? *Cteniscus gnathoxanthus* var. 2 Brischke, *Schrift. Phys.-ökon. Ges. Königsberg*, **11**: 98 (*non* Gravenhorst 1829).

1878 ? *Cteniscus gnathoxanthus* var. 2 Brischke, *Schrift. naturf. Ges. Danzig*, **4**: 105 (= *Ct. gnathoxanthus* var. 2 Schmiedeknecht 1912: 2329).

1911 *Exenterus elegans* Morley, *The Ichneumons of Great Britain*, **4**: 204–205.

1914 *Cteniscus aulicus* Roman, *Ark. Zool.* **9** (2): 14–16, **syn.n.**

1948 *Cteniscus elegans* Teunissen, *Tijds. Ent.* **89**: 13.

The unique female type of *Cteniscus aulicus* Roman was taken by Boheman in the southern Swedish province of Blekinge. Roman first labelled it '*aulicus* Rn n.sp.? = *fulvipes* Krb. ♀'. Evidently added at a later date is a second label in Roman's handwriting '? *elegans* Stph.' Having with me a pair of Stephens's species, previously compared with the type, I have been able to compare Roman's type with them, and can establish their specific identity.

Head slightly but rather sharply narrowed behind eyes, then rounded; about as long behind eyes as eye length, seen from above; shallowly emarginate behind: on vertex, temples and cheeks finely and rather sparsely punctate, more densely so near occiput and lower genal margin: less finely and sparsely punctate than temples is the lower face, particularly on epistoma: upper face still more closely punctate, with strong scrobal impressions, and usually with a distinct Y-shaped furrow below median ocellus. Clypeus somewhat sparsely beset with punctures of mixed sizes, fine to moderate or rather coarse, denser near basal margin; rather deeply and sharply delimited basally; strongly convex in basal half, strongly impressed before the reflexed and narrowly rounded apex. Malar space equal to distance between mandibular apices in female, rather less in male. Hypostomal costa bent outward, strongly and roundedly raised to where met by genal costa rather close behind mandibular base, thence falling gradually to foramen magnum.

Antennae with scape moderately excised externo-ventrally: flagellum 27- to 29-segmented, slightly expanded in middle, therefrom tapering gradually to apex.

Pronotum with dorsal transverse furrow moderately impressed, broader in middle; with epomiae weak or very weak; laterally rather finely punctate above, more or less rugose or rugulose below. Propleura rather finely punctate, quite densely so at sides. Mesoscutum rising sharply from pronotum, rather strongly or strongly convex in front, but more flattened behind; with notaulices sharply impressed; very finely and rather sparsely punctate discally, less finely and more densely so peripherally, and especially in front. Scutellum moderately convex, somewhat flattened discally; finely and for the most part sparsely punctate; not margined beyond scutellar fovea. Mesopleura moderately punctate below, more finely so above: sternaulices weakly to moderately impressed: mesosternum and prepectus moderately punctate: mesolcus normally impressed; posteriorly a little widened, and transcostate but scarcely closed. Propodeum more or less rugulose, or on area posteromedia partly rugose; on area externa finely, and on area pleuralis moderately and densely punctate; with costae normally complete, but mostly rather weak: area superomedia about as broad as long, strongly contracted from costulae to base, generally (but not in type) basally delimited.

Gaster spindle-shaped in female, behind petiolar segment parallel-sided or somewhat narrowed in male. Petiolar segment 1·2 to 1·3 times length of its greatest breadth in female, 1·4 to 1·6 times in male; with basal lobes distinct but not strong; not strongly margined, with spiracles well before middle and not prominent; rather strongly raised in middle, but not as much so as in *curtisii* Hal.; with dorsal keels moderate or rather strong, distinct to beyond middle; smooth at mid apex and between keels; very obscurely rugose beside the keels, finely and distinctly so near apical angles. Remainder of gaster smooth and shining: tergite 2 with thyridia distinct, very narrow in female, more crescentic in male. Female hypopygium much as in *hofferi* Gregor: female third valvulae more pointed than in that species, reaching to about apex of tergite 8.

Wings as described for *hofferi* Gregor, but nervellus not so strongly antefurcal.

Claws of all tarsi rather strongly pectinate.

Length 7 mm.

Head black; with palpi, mandibles except at apex, and clypeus stramineous-white: the palpi and mandibles are to some extent suffused fulvous, and the clypeus is fulvous along extreme apical margin. Antennae with scape and pedicellus black or almost so, marginally paler; with annellus and extreme base of postannellus pale;

with remainder of flagellum dull fulvous below, ferrugineous above, the basal segments apically paler. Thorax and propodeum black, with lower angles of pronotum pale; with humeral angles of pronotum and with tegulae stramineous; with scutellum and metascutellum stramineous to flavous at apex, discally rufo-fulvous. Legs with all coxae and femora bright fulvous, the femora paler at apex: trochanters and trochanterelli stramineous, the hind trochanters basally fulvous: fore and mid tibiae and tarsi more or less pale dull fulvous, the tarsi dark at extreme apex: hind tibiae broadly at apex and tarsi ferrugineous, the tibiae mainly dull fulvous, broadly dull stramineous at base. Wings with veins and stigma ferrugineous, basally stramineous. Gaster coloration as described for *hofferi* Gregor.

Redescribed from the following material: ENGLAND, Kent, Darenth Wood, type ♀, J. F. Stephens; Devon, Barnstaple, 1 ♀, T. A. Marshall coll.; Staffs., Lichfield dist., 1 ♂, 1 ♀, 1922, L. A. Carr: GERMANY, Köln, 1 ♀, 13.v.1940, W. Aerts: CZECHOSLOVAKIA, Moravia, Pouzdřany, 6.vi.1937, Fr. Gregor.

Additional material seen: SWEDEN, Skåne, Esperöd, 1 ♂, 20.vi, 1 ♀ (probably also from Skåne), C. G. Thomson; Blekinge, 1 ♀, C. Boheman (type of *aulicus* Roman). Recently recorded from Holland (Teunissen 1948).

Brischke's *Ctenicus 'gnathoxanthus* var. 2', recorded from the Danzig district (1878), may very well be this species. It was reared from *Periclista pubescens* Zadd., a sawfly species attached to *Quercus*.

Ctenicus pectoralis Hellén

1951 *Ctenicus pectoralis* Hellén, *Notul. ent., Helsingf.* **31:** 31.

Head rather strongly transverse, a little shorter behind eyes than eye length, seen from above; very slightly narrowed behind eyes and then rounded; rather shallowly emarginate behind: on vertical region and temples for the most part very finely and sparsely punctate, but near occiput and on cheeks less finely and sparsely so, and by lower genal margin moderately alutaceo-punctate: lower face moderately to rather coarsely and densely punctate: upper face rather finely and densely so, with transverse rugosities just above antennal sockets, and with a distinct inter-antennal keel. Clypeus rather sparsely beset with punctures of mixed sizes, fine to rather coarse; sharply but not deeply delimited basally; strongly projecting though weakly convex; scarcely impressed before the moderately rounded apex. Malar space (female) clearly greater than distance between mandibular apices. Hypostomal costa more than slightly but not strongly raised; met by genal costa at about a right angle, as far behind mandibular base as length of malar space.

Antennae with scape somewhat strongly convex dorsally, about as much so as in *curtisii* Hal. but more elongate, moderately excised externo-ventrally (both broken off beyond postannellus in unique type).

Pronotum with dorsal transverse furrow sharply impressed, bisected by a median keel; with epomiae short and weak; laterally finely punctate and shining before humeral angle, but in greater part obsoletely rugose. Propleura shallowly, moderately to rather coarsely and densely punctate. Mesoscutum moderately convex; with notaulices strongly and sharply impressed; shallowly but coarsely and closely punctate and obsoletely rugose between notaulices, merging to much more finely punctate peripherally and behind. Scutellum rather strongly convex; very finely punctate; not margined beyond scutellar fovea. Mesopleura rather finely to moderately and not closely punctate; with a large impunctate speculum: sternaulices very superficial: mesosternum moderately punctate in front, more finely and sparsely so behind: prepectus moderately punctate: epicnemial carina indicated but incomplete medially: mesolcus moderately impressed, greatly broadened and with several transverse costae but not closed behind. Propodeum for the most part obsoletely rugose, but with areae superomedia, dentipara, and posteromedia near mid apex, quite strongly so; with areae externa and pleuralis finely punctate; with costae quite strong at sides and behind, but weaker and irregular above, including the costulae: area posteromedia not reaching middle: area superomedia about as long as broad, not delimited basally.

Petiolar segment elongate, 1·6 times length of its greatest breath; with a narrow waist near base and then strongly explanate (rather as in *Eclytus fontinalis* Hlgr. but not strongly contracted again just before apex); sharply margined laterally; with dorsal keels strongly raised, sharp to about level of spiracles but continuing blunter to about last quarter of segment, bounding a median longitudinal pit and falling sharply to lateral furrows; finely rugulose, smooth near mid apex. Remainder of gaster elongate and slender: tergite 2 a little expanded to apex, with thyridia small but distinct: remaining tergites contracted to apex, tergites 3 to 5 each the length of its basal breadth: tergites 2 and 3 finely alutaceo-punctate, the remainder very finely punctate and shining. Female hypopygium elongate, folded mid-ventrally but not sharply so: female third valvulae elongate, narrow in ventral view, somewhat pointed in side view, strongly hairy, extending far beyond apex of tergite 8.

Fore wings with radial cell almost three times as long as broad; with basal and disco-cubital veins almost parallel; with areolet shortly petiolate, not broad; with nervus parallelus emitted below middle of brachial cell. Hind wings with nervellus strongly antefurcal, and intercepted well below middle.

Legs, notably hind femora and tibiae, very elongate and slender. Claws of hind tarsi each with three, rather small, widely spaced comb-teeth.

Length 11½ mm.

Head black, with the following parts stramineous, tinged with flavous: labium and maxillae, clypeus, and lower face continuous with genae broadly: there are fulvous upper margins to pale part of genae and lower face, and a small median mark of the same colour on upper part of lower face: mandibles more ochreous, black at apex. Antennae with scape, pedicellus and annellus pale ferrugineous to castaneous above, merging to deep flavous below: postannellus deep ferrugineous. Thorax and propodeum black, with the following rufo-fulvous above, pale dull flavous below: pronotum, scutellum, metascutellum, mark above epicnemial carina extending down prepectus, and mark above mid coxa, these last two faintly connecting across mesopleuron: propleura pale flavous, tinged with fulvous: humeral angle of pronotum and mark below fore wing pale bright flavous, tegulae duller: mark below margin of scutellar fovea and marks on propodeum dull rufous: hind margins of mesopleuron, scutellum and metascutellum obscurely pale. Fore and mid coxae, trochanters and trochanterelli coloured as propleura: fore and mid femora fulvous, obscurely paler at base and apex, and their tibiae and tarsi paler: hind coxae rufous, as also hind trochanters and trochanterelli in inner side view and below; but the last two infuscate in outer side view and pale at base and apex: hind femora, tibiae, and tarsi deep ferrugineous; with femora and first four tarsal segments pale at extreme base and apex; with tibiae pale at base and extreme apex; with fifth tarsal segment, and fourth below, pale rufous. Wings with veins and stigma ferrugineous, the stigma very pale at base. Gaster black above, stramineous to pale flavous below: tergites 1 to 6 with narrow, pale apical margins and tergite 7 with an obscure, triangularly broadened one: third valvulae pale, partly infuscate above, and rufous towards apex.

Redescribed from the unique holotype, FINLAND, Esbo, 1 ♀, R. Frey.

Most closely related to *Ct. unicinctus* Hlgr. in the elongate, slender body, and particularly the legs; in the ventrally folded (though not sharply folded) hypopygium; and in the pale pectoral coloration. It differs notably from that species, however, in having the head slightly shorter behind eyes than eye length, seen from above; and is unique among known palaearctic species in having the gaster so elongate that tergites 4 and 5 are as long as their breadth at base. As to whether the imperfectly formed epicnemial carina is a good specific character or a mere individual variation, remains to be seen.

I wish to thank Dr. W. Hellén for his close co-operation in allowing me, before his description had appeared in print, to make a study of his very distinct and interesting species for inclusion in my paper.

Cteniscus unicinctus Holmgren

1858 *Exenterus unicinctus* Holmgren, *Svensk Vet.-Akad. Handl.* **1**: 234.
1858 *Exenterus macrocephalus* Holmgren, ibid.: 243 (synonym by Roman 1914).
1896 *Cteniscus macrocephalus* Jacobs & Tosquinet, *Ann. Soc. ent. Belg.* **34**: 108.
1914 *Cteniscus unicinctus* Roman, *Ark. Zool.* **9** (2): 17.
1942 *Cteniscus unicinctus* Kerrich, *Trans. Soc. Br. Ent.* **8** (2): 63–64.

Head much longer behind eyes than eye length, seen from above; distinctly broadened and rounded behind eyes, in well-developed specimens strongly so; somewhat strongly and sometimes rather angularly emarginate behind: on vertical region, temples and inner orbits finely to rather finely and rather sparsely punctate, on upper face closely so; genae and epistoma rather finely to moderately and closely punctate. Clypeus strongly transverse, more than twice as broad as long; fairly closely beset with punctures of different sizes, fine to rather coarse; not deeply delimited basally; weakly convex before the slightly reflexed and very broadly rounded apex. Malar space a little less than distance between mandibular apices in female, a little more than half this distance in male. Hypostomal costa bent strongly outward, very slightly and evenly raised; met by genal costa, at nearly a right angle, as far behind mandibular base as distance between mandibular apices. Mandible with lower tooth more prominent than upper, rather in the manner of *Acrotomus* and *Anisoctenion*, but always a little shorter.

Antennae with scape (Fig. 82) strongly convex dorsally, rather weakly excised externo-ventrally; with pedicellus relatively elongate; with postannellus about one-eighth longer than following segment; with flagellum filiform, decidedly slender, 23- to 26-segmented.

Pronotum strongly produced forward, as in *Anisoctenion alacer* Grav.; with dorsal transverse furrow strongly impressed, broad and shining; with epomiae of moderate strength, sharp, not shortened below; laterally rather finely and closely punctate above, with some rugosity developed below. Propleura finely punctate; with outer hind angles strongly produced and reflected. Mesoscutum rather strongly convex; with notaulices of moderate strength, extending well back on to disk; very finely punctate or, to a greater or lesser extent, not so finely so. Scutellum moderately convex; finely and closely punctate above and behind, very finely and sparsely so at sides; not margined beyond scutellar fovea. Mesopleura finely punctate above, rather finely to moderately and not closely so below (never so closely as in *curtisii* Hal.): sternaulices rather shallow, but broad and very distinct: mesosternum finely and closely punctate; prepectus rather coarsely and very closely so, bearing a pair of short keels just behind lower angles of pronotum: epicnemial carina quite distinctly though not strongly elevated: mesolcus sharply impressed, partly closed behind. Propodeum relatively elongate and not abruptly declived; with pilosity long but not thick; generally finely punctate on area externa, elsewhere very finely so, shining, seldom with much rugulosity; with costae sharp at sides and behind and with costulae complete: area superomedia about one and a half times as long as broad, or longer, not basally delimited.

Petiolar segment elongate, 1·8 to 2·3 times length of its greatest breadth; almost regularly expanded from near base to near apex, though sometimes the spiracles are prominent; with dorsal keels sharp, approaching rather closely before and between spiracles, distinct for about two-thirds length of segment; very obscurely rugose between and beside keels, smooth and shining behind. Remainder of gaster smooth and shining: tergite 2 with thyridia distinct. Female hypopygium sharply folded medially in apical half: female third valvulae elongate pilose, projecting beyond apex of tergite 8, small, varying considerably in shape.

Fore wings with basal and disco-cubital veins not strongly divergent; with areolet sessile to shortly petiolate; with nervus parallelus emitted a little below middle of brachial cell. Hind wings with nervellus distinctly antefurcal and intercepted far below middle.

Legs elongate and slender. Tarsal claws with short, fine pectination, weaker in male.

Length 7 to 8½ mm. in specimens redescribed, but down to 4 mm. in a female specimen from Lapland.

Female. Head colour as described for *Exyston genalis* Thoms. (p. 376), but pale coloration sometimes extending on to upper face right round antennal sockets. Antennae bright ochreous; with scape and pedicellus pale beneath, ferrugineous marked at sides; with annellus pale; with following few segments ferrugineous, pale at apex. Thorax and propodeum black, with the following parts stramineous to pale flavous, to some extent flushed with rufous: tegulae, pronotum very largely, propleura and mesosternum totally, mesopleura below tegulae, along front and hind margins, and largely below; often pale-marked also on metascutellum and propodeum:

scutellum usually distinctly but sometimes rather obscurely pale-marked, near mid apex or more extensively on disk, at sides of hind margin, and below margins of fovea. Similarly pale-coloured are the coxae, trochanters, trochanterelli, and base and apex of hind femora: legs otherwise more testaceous, but with hind femora mainly ferrugineous, hind coxae above and usually hind tibiae above and at apex marked with the same colour. Wing colour as described for *Ct. elegans* Steph. Gaster mainly black above, flavous to testaceous below, including the hypopygium, and sometimes also the whole of tergites 6 to 8: tergite 1 with a median pale mark very near apex; and remaining black tergites with pale apical margins, which are usually triangularly produced forward conspicuously on 2 and 3, and sometimes more obscurely on 4: thyridia small, but pale and conspicuous.

Male differs as follows: pale coloration of head just reaching up to antennal sockets, and extending to a line going from a point on hypostomal costa rather close behind mandibular base to a point about a quarter the way up outer orbit. Antennal flagellum darker, sometimes in greater part ferrugineous. Pronotum black, except for lower and humeral angles: propleura usually only marginally pale: mesopleura below and mesosternum black, except sometimes for margin of prepectus and a Y-shaped mark by sternaulices: scutellum and metascutellum not or obscurely pale-marked in middle, and propodeum unmarked. Hind tibiae and also hind tarsi above often more strongly ferrugineous marked: hind coxae sometimes mainly ferrugineous. Black coloration extending nearer lateral margins of tergites 3 and following, and tergites 6 and 7 only very narrowly pale at apex: in one southern Swedish specimen the pale marks on tergites 2 and 3 greatly reduced; and, according to Holmgren (p. 234), only the second tergite conspicuously pale-banded in type material from Lapland.

Redescribed from the following material: ENGLAND, Hants, New Forest, 1♀, vi.1902, D. Sharp: FRANCE, Paris district, Maisons Laffitte, 1 ♂, Forêt de St. Germain, 1 ♀, 11.v., Fontainebleau, 1 ♀, 12.vi.1900, J. de Gaulle: BELGIUM, Groenendaele, 1 ♀, 27.vi.1892, 1 ♀, 8.vii.1880, J. Tosquinet: GERMANY, Berlin district, 1 ♀, 1.vi.1856, Ruthe coll.: SWEDEN, Skåne, Höör district, 2 ♂♂, 8.vi, 1 ♂, 10.vi.1938, D. M. S. & J. F. Perkins.

Further material seen: SWEDEN, type and other specimens in Royal Natural History Museum, Stockholm (see Roman, 1914, Kerrich, 1942).

Cteniscus consobrinus Holmgren

Head shape in dorsal view as described for *unicinctus* Hlgr.: punctation much as described for that species, but in general somewhat finer and denser. Eyes in male slightly convergent. Clypeus as described for *unicinctus* Hlgr., but deeply delimited basally, and in male not very broadly rounded at apex. Malar space about equal to distance between mandibular apices in both sexes. Hypostomal and genal costae as described for *unicinctus* Hlgr., but meeting at much less than a right angle. Mandible with lower tooth in same plane as and distinctly shorter than upper.

Antennae with scape of normal proportions, rather weakly excised externo-ventrally; with postannellus about 1·3 times length of following segment; with flagellum not relatively slender, 24- to 25-segmented.

Pronotum much less produced forward than in *unicinctus* Hlgr., sharply declived to the dorsal transverse furrow; with epomiae rather weak, evanescent below; laterally finely and not very distinctly punctate above, strongly rugose below. Propleura as described for *unicinctus* Hlgr. Mesoscutum rising sharply from pronotum, moderately convex; with notaulices rather strongly impressed but short, not quite reaching anterior margin; finely to very finely and obscurely punctate. Scutellum moderately convex; very finely punctate; margined a little beyond scutellar fovea. Mesopleura finely and not closely punctate below, sparsely and very finely so above: sternaulices broad but superficial: mesosternum very finely punctate, prepectus rather finely so: epicnemial carina slightly elevated: mesolcus shallowly impressed anteriorly, deeply so posteriorly, partly closed behind. Propodeum rugulose-punctate, but with area pleuralis in large part shining; with costae including costulae sharp: area superomedia distinctly longer than broad, almost parallel-sided, not distinctly delimited basally, emitting costulae before middle.

Petiolar segment 1·4 times length of its greatest breadth in type female, 1·7 to 2·0 times in male; with dorsal keels of moderate strength, distinct to beyond middle; dorsally coriaceo-rugose, smooth only near mid apex. Tergite 2 weakly coriaceous at base; with thyridia distinct. Remainder of gaster smooth and shining. Female hypopygium pointed but not sharply folded: female third valvulae broad, rather strongly pointed, projecting beyond apex of tergite 8.

Fore wings as described for *unicinctus* Hlgr.: hind wings with nervellus less antefurcal and intercepted not so far below middle.

Tarsal claws with pectination of moderate strength in female, weaker in male.

Length 7 to 7½ mm.

Head coloured as in *Ct. romani* nov. (p. 430). Antennae dull ferrugineous, somewhat paler beneath; with scape, pedicellus and basal flagellar segments paler at apex; with scape and pedicellus beneath and with annellus conspicuously pale. Thorax and propodeum black, with the following pale: humeral angles of pronotum and tegulae distinctly, hind margin of scutellum at sides and mark below hind wing, and outer hind angle of propleura obscurely. Legs pale rufous; with trochanters and trochanterelli, and fore and mid coxae at least in part, pale flavous; with coxae otherwise darker, the hind coxae largely blackish, and with hind trochanters dark-marked above. Wing colour as described for *Ct. elegans* Steph. Gaster colour as described for *Ct. gnathoxanthus* Grav. except for female hypopygium which is ferrugineous, pale at mid base and with narrow pale margin.

Redescribed from the following material: IRELAND, Co. Wicklow, Glen of Imaal, 1 ♂, 27.v.1926, A. W. Stelfox: SWEDEN, Lapland, 1 ♀, 25.vii (holotype), 1 ♂ (allotype), C. Boheman.

Cteniscus rufonotatus Holmgren

1858 *Exenterus rufonotatus* Holmgren, *Svensk Vet.-Akad. Handl.* **1:** 243.
1883 *Cteniscus breviventris* Thomson, *Opuscula Entomologica*, fasc. 9: 890, **syn. n.**
1896 *Exenterus fulvipes* Kriechbaumer, *Ent. Nachrichten*, **22:** 369, **syn. n.**

Head strongly transverse, a little shorter behind eye than eye length, seen from above; rather strongly or strongly narrowed and rounded behind eye; shallowly emarginate behind: on vertex, temples, cheeks, and inner orbits very finely punctate, for the most part rather sparsely but on cheeks quite sparsely so; on upper face finely, very seldom in part closely punctate; on epistoma rather finely and not closely punctate. Clypeus sparsely beset with rather coarse punctures; sharply delimited basally; strongly convex to near the reflexed and more or less narrowly rounded apex. Malar space about five-eighths distance between mandibular apices. Hypostomal costa slightly and almost evenly raised, met by genal costa not close behind mandibular base. Mandibles with lower tooth distinctly a little longer and more prominent than upper, suggesting the condition in genus *Anisoctenion*.

Antennae with scape as described for *gnathoxanthus* Grav.; with flagellum rather stouter and more coarsely hairy, as in *gibbulus* Hlgr., 21- to 25-segmented.

Pronotum with dorsal transverse furrow strongly and quite sharply impressed, distinctly transcarinate; with epomiae rather strong; laterally finely or very finely punctate above, weakly to more or less strongly rugose below. Propleura finely and rather densely punctate. Mesoscutum rising sharply from pronotum, rather strongly convex, though somewhat flattened on disk; with notaulices rather strongly and sharply impressed; for the most part very finely punctate, more sparsely so on disk. Scutellum as described for *gnathoxanthus* Grav. Mesopleura rather closely beset with moderate punctures below, finely punctate above, and with speculum extending far forward: sternaulices usually ill-defined and rather superficial: mesosternum finely and closely punctate in front, more finely and sparsely so behind, its halves distinctly convex: prepectus closely punctate, distinctly excavate: epicnemial carina slightly elevated: mesolcus strongly impressed, wider and deeper posteriorly, partly closed behind. Propodeum strongly raised to base of area superomedia; shining and for the most part obsoletely rugose in front, quite strongly rugose behind, including about half area pleuralis; with costae including costulae strong: area posteromedia with median keel usually strong and percurrent: area superomedia a little longer than broad, emitting costulae about in middle, strongly contracted therefrom to base, where it is more or less distinctly delimited.

Gaster stoutly spindle-shaped in female, with sides decidedly rounded even in male. Petiolar segment of female 1·1 to 1·2 times length of its greatest breadth; strongly narrowed to base; without basal lobes, but with sides almost evenly rounded and sharply margined, the spiracles seldom at all prominent; dorsally weakly rugose to coriaceous or even smoother, smooth near mid apex; moderately raised in middle, with dorsal keels distinct for about three-quarters length of segment: petiolar segment of male about 1·3 times length of its greatest breadth; with spiracular tubercles prominent; dorsally more distinctly rugose, with keels sharp and generally almost percurrent. Remainder of gaster for the most part smooth and shining; tergite 2, however, slightly elevated in about basal half between thyridia; often weakly coriaceous upon this elevation, occasionally more strongly or extensively sculptured. Female hypopygium broadly rounded at apex, appearing almost truncate in middle when sides are folded: female third valvulae narrow (Fig. 86), projecting slightly beyond apex of tergite 8.

Wings as described for *curtisii* Hal. but areolet may be longer petiolate: stigma and radial cell broad, the latter about 2·1 times as long as broad.

Hind legs relatively stouter than in *gnathoxanthus* Grav. and *gibbulus* Hlgr.; but tibiae not so much thickened as in *hofferi* Greg. (Fig. 81), and metatarsi not thickened. Tarsal claws rather weakly and sparsely pectinate, more weakly so in male.

Length 4½ to 7 mm.

Female. Head black, with the following parts bright stramineous, margined with rufous: palpi, mandibles except at apex, clypeus, and broad marks on genae: these approach, or more often traverse, the hypostomal costa just behind lower articulation of mandible, and they extend through malar space usually up to the tentorial pits, and thence triangularly about half way up orbits of lower face. Occasionally the lower face is colour-patterned as in *curtisii* Hal., or less extensively. Antennae rufous to ferrugineous, paler towards apex and below. Thorax and propodeum black, with the following parts stramineous to flavous: humeral angle of pronotum and mark in lower angle, which extends some way forward, propleura, and tegulae: hind margin of scutellum and metascutellum at sides, and mark below hind wing obscurely pale: scutellum sometimes dull castaneous behind. Legs mainly clear red, to some extent rather paler; with fore and mid coxae, except at base, trochanters and trochanterelli flavous; with hind tarsi darkened extensively but hind tibiae at apex only; sometimes with hind femora at apex and hind coxae blackish. Wings distinctly infumate; with veins and stigma pale ferrugineous, much paler at base. Gaster black above, the tergites with yellowish apical and lateral margins: tergite 2 sometimes, as in Holmgren's type, with a more or less triangular red mark and with thyridia castaneous: venter mainly pale, the sternites with large, paired dark marks; the hypopygium dark, with narrow pale margin.

Male differs as follows: pale mark of gena and lower face less extensive. Propleura pale at apex only.

Redescribed from the following material: IRELAND, Co. Wicklow, Rathdrum, 1 ♀, 13.viii.1925, A. W. Stelfox: BELGIUM, unlocalized, 4 ♀♀, C. Wesmael; Genck, 2 ♀♀, 25.viii.1886, 1 ♀, 21.viii.1892, Sichem, 2 ♂♂ (one the type of *fulvipes* Kriechb.), 1 ♀ (hereby selected as allotype of *fulvipes* Kriechb.), 19.ix.1885, Schaffen, 2 ♀♀, 18.ix.1885, 1 ♀, 10.ix.1886, Molenstedt, 2♀♀, 23.ix.1886, Cagervine, 1 ♀, 25.ix.1885, J. Tosquinet: SWEDEN, Skåne, Torekov, 1 ♂, vii.1860 (lectotype of *breviventris* Thoms.), Räften, 1 ♀, 12.viii (allotype of *breviventris* Thoms.), ? C. D. E. Roth, C. G. Thomson coll.; Småland, 1 ♀ (type), C. Boheman: SWITZERLAND, Geneva, Peney, 1 ♀, 15.viii.1884, Tournier; Champel, 1 ♀, coll. Buess: SPAIN, Orviedo, Gijon, 1 ♂, viii.1900: RUSSIA, Dniepropetrovsk, 1 ♂, 7.ix.1943, R. Hinz.

Material of this species stood in the Brussels museum collection under the Holmgren and the Kriechbaumer names, and included the Kriechbaumer type: the two series were associated, and the synonymy was confirmed by examination of the Holmgren type. The clue to synonymy of Thomson's name was given by specimens, determined independently and from literature, by Ch. Ferrière and A. W. Stelfox; and this was confirmed by examination of the two syntypes.

Additional material examined: FINLAND, Hangö, Keuru, 2 ♀♀ (Hellén, 1937: 125; 1941: 48): HOLLAND, Ermelo, 1 ♀, 9.ix.1936, J. Lindemans (this specimen has a pair of pale marks flanking the costa that partly closes the mesolcus); Made, 1 ♀, 2.ix. 1942, Oploo, 1 ♀, 16.ix.1947, H. G. M. Teunissen. Dr. Teunissen came independently to the conclusion that *breviventris* Thoms. and *fulvipes* Kriechb. were conspecific with *rufonotatus* Hlgr.; but I must contest his placing of *rufonotatus* and *breviventris* as varieties of *Ct. lineola* Steph. (1948: 13). The unique male type of *lineola* is in the British Museum (Natural History) and is in very poor condition; but it is undoubtedly a different species.

Ct. rufonotatus Hlgr. and *dahlbomi* Hlgr.

Roman (1914: 16), from a study of the two uniques, placed *rufonotatus* Hlgr. in synonymy with *dahlbomi* Hlgr.: I do not understand the reference to Schmiedeknecht, who merely compiled a description from the two diagnoses given by Holmgren, whereas Roman had the type before him. Having now been able to study *rufonotatus* from adequate material, I must dissent from the synonymy given in 1914. *Ct. dahlbomi* differs principally in the following respects.

Head not thus strongly transverse, more strongly punctate: mandibles not as described for *rufonotatus* but strongly narrowed to middle and then expanded: notaulices rather weakly impressed: mesopleura more coarsely and less closely punctate below: propodeum not short, not strongly raised from base nor falling so steeply behind: area superomedia much longer than broad, emitting costulae before middle and not strongly contracted to base: female hypopygium pointed at apex.

The lower face is bright flavous, apart from a rather narrow, median dark band. The scutellum is distinctly pale-marked at mid apex. The gaster is dull castaneous above: tergites 2 to 8 have bright flavous apical margins, which on 2 to 5 are preceded by large, triangular rufous marks: the petiolar segment has a trace of such pale marking at mid apex. The species would, therefore, reckon as a red-bodied species according to the definition given at the head of the key to species (p. 443 below). Stigma and radial cell are broad, as in *rufonotatus*.

The male type of *gracilis* Hlgr. corresponds well with the above, and I think that *dahlbomi* Hlgr. may well prove to be synonymous with it: the lower face, cheeks, and lower angle of pronotum are not pale-marked. On the other hand, I reject the synonymy (Roman, 1909: 285) of *gracilis* Hlgr. with *funebris* Hlgr., which I would classify as a black-bodied species: it is a larger and more coarsely sculptured form, with stouter scape and petiolar segment, with nervellus intercepted not far below middle, with scutellum not pale-marked at mid apex, and with tergites of gaster not rufous marked but merely dull castaneous, with rather obscure pale apical margins.

Cteniscus gnathoxanthus Gravenhorst

Head moderately to rather strongly narrowed behind eyes in female and strongly so in male; somewhat strongly emarginate behind: on vertex, temples, and cheeks rather closely, generally finely but on upper genae in larger specimens moderately punctate, on epistoma and upper face moderately and more or less closely, and on inner orbits very finely punctate: eyes in male distinctly convergent. Clypeus rather sparsely beset, mostly with moderate punctures; deeply and sharply delimited basally; strongly convex in basal half, and more or less strongly impressed before apex, which is moderately, or sometimes rather broadly rounded. Malar space about three-quarters distance between mandibular apices in female, about, usually less than, half such distance in male. Hypostomal costa slightly raised to where met by genal costa, not close behind mandibular base. Mandible (Fig. 4).

Antennae with scape (Fig. 83) rather elongate, moderately excised externo-ventrally; with postannellus rather elongate, about 1·5 times length of following segment; with flagellum 25- to 29-segmented.

Pronotum with dorsal transverse furrow strongly impressed; with epomiae of moderate strength; laterally finely or rather finely punctate, with a greater or lesser amount of rugosity below. Propleura closely and rather finely punctate. Mesoscutum rather weakly convex, almost flattened on disk; with notaulices sharp and rather strongly impressed; rather finely punctate discally, finely to very finely so peripherally. Scutellum generally rather weakly but sometimes more strongly convex, flattened and generally to some extent buckled discally; finely punctate, generally rather sparsely so above and at sides; not margined beyond scutellar fovea. Mesopleura closely and rather finely punctate below, finely and rather sparsely so above: sternaulices very superficial: mesosternum rather finely and closely punctate, prepectus moderately and closely so: mesolcus moderately impressed, broadened beyond middle, usually well closed behind. Propodeum shining and obsoletely rugose above, generally quite clearly punctate on area pleuralis; with costae of moderate strength but costulae irregular: area superomedia seldom delimited basally, distinctly longer than broad, emitting costulae a little before middle.

Petiolar segment of female 1·1 to 1·3 times length of its greatest breadth; not so broadly based as that of *curtisii* Hal. but more distinctly explanate, rather roundedly so and generally not strongly margined; with spiracles situated well before middle and normally not prominent; dorsally obscurely to moderately rugose, with keels distinct to well beyond middle, where it is quite strongly raised: petiolar segment of male longer, 1·3 to 1·8 times length of its greatest breadth; with strong, nearly straight-sided margins and more or less prominent spiracles; dorsally distinctly rugose, with keels strong and sharp and extending about three-quarters length of segment. Remainder of gaster smooth and shining: tergite 2 with thyridia usually narrow in female, broader and more conspicuous in male. Female hypopygium generally rather pointed (considerable variation in this): female third valvulae broad, distinctly finely punctate, normally projecting beyond apex of tergite 8 (Fig. 85).

Wings as described for *curtisii* Hal., but the areolet may be longer petiolate, and the nervellus is often intercepted very far below middle: stigma and radial cell not so elongate as in species with thickened hind tibiae, but more so than in the closest relatives, radial cell about 2·7 times length of its greatest breadth.

Hind tibia and metatarsus of normal proportions (fig. 80): claws of all tarsi rather strongly pectinate.

Length 6 to 9 mm.

Female. Head black, with the following bright stramineous, margined with rufous: palpi, mandibles except at apex, clypeus, and mark going through malar space usually up to the hypostomal costa: lower face black, with only slight extensions of malar marks up the orbits, or with greater or lesser development of similar pale colour; in extreme case black only in mid line, rather broadly below antennae to eye margin, and almost always just above tentorial pit. Antennae black merging to ferrugineous above, paler below; with basal segments paler at apex. Thorax and propodeum black, with humeral angle of pronotum and tegulae stramineous to flavous; with hind margin of scutellum only at sides and with mark below hind wing stramineous; with ventral margin of pronotum distinctly or obscurely pale at sides. Legs mainly red, the fore and mid tibiae and tarsi rather paler; with fore and mid trochanters and all trochanterelli flavous, and fore and sometimes mid coxae somewhat flavous-marked; with hind tibiae black, rufous in part beneath, distinctly stramineous at base and rufous at extreme base; with hind tarsi black, the segments paler at apex and sometimes beneath. Wings with veins and stigma ferrugineous, paler at base: axillary sclerites flavous. Gaster black above, the tergites having narrow pale apical and pale lateral margins, broader on the hinder segments: venter mainly pale, the hypopygium with or with traces of a broad, V-shaped dark mark well inside margin, and the other sterna with large, paired dark marks: thyridia castaneous.

Male differs as follows. Lower face may be entirely pale except for a small median band in upper part; and pale colour may extend up orbits above antennal sockets. Scape sometimes pale beneath. Legs with a great infusion of flavous into the rufous parts, the coxae being generally mainly flavous: Irish males, however, have the hind coxae mainly black and the hind femora dark. Pale apical margins of tergites 2 and 3 may be broader: hypopygium and previous sternite mainly black.

Redescribed from the following material: IRELAND, Co. Kildare, Landenstown, 1 ♀, 20.viii.1941, Skerries Bog, 3 ♀♀, 26.ix.1946; Co. Wicklow, Rathdrum, 1 ♀, 6.viii.1927, Athdown, 1 ♂, 20.viii.1944, A. W. Stelfox; Co. Dublin, Howth Castle, in wood, 1 ♂, 10.viii.1939, F. J. O'Rourke: ENGLAND, unlocalized, 1 ♀, T. Desvignes coll.; Norfolk, Catfield, 1 ♀, 16.vii.1920, J. J. F. X. King: BELGIUM, unlocalized, 1 ♀ C. Wesmael; Vivier d'Oie, 1 ♀, 13.vii.1884, 1 ♀, 23.vii.1880, 1 ♀, 28.ix.1880; St. Croix, 1 ♀, 4.x.1876; Schaffen, 2 ♀♀, 22.ix.1885; Schelle, 1 ♀, 11.viii.1885; Carlsbourg, 1 ♀, 12.vi.1880; Groenendaele, 1 ♀, 15.ix.1891; ? locality, 1 ♀, 14.ix.1885, J. Tosquinet: SWEDEN, Skåne, Fjällfota sjö, on *Salix*, 2 ♀♀, 7.viii.1938, D.M.S. & J.F. Perkins; Hälsingland, Bergvik, bred from under bark, 3 ♂♂, 5 ♀♀, em. 16–19.vi.1947, O. Lundblad: FINLAND, Sortavala, Rauskunvuori, 1 ♀, 21.viii.1935; Ladoga, Valamo, Pienennukkananlahti, 1 ♀, 31.viii.1935, G. J. K. (see Kerrich, 1940*a*): FRANCE, unlocalized, ? France, 1 ♀, coll. Puton (Mus. Paris): GERMANY, unlocalized, ? Germany, 2 ♀♀, O. Schmiedeknecht; probably Berlin district, 5 ♀♀, Ruthe coll.; Celle, 1 ♀, 29.viii.1942; Göttingen, 1 ♀, 11.ix.1946, R. Hinz; Bavaria, Görkau, 1 ♀, vii.1930, Th. Kupka: CZECHOSLOVAKIA, Bohemia, Chodau, 1 ♀, 5.ix.1885, 1 ♀, 19.vii.1925, R. von Stein; Erzgebirge, Aussig, 1 ♀, 27.viii.1933; Teschen, Rosenberg, 1 ♀, 7.vii.1936; Bohumin, Haatsch, 1 ♀, 23.viii, 1 ♀, 28.viii, 1 ♀, 20.ix.1936, Th. Kupka.

A black-bodied species without thickened hind legs, and with scutellum not pale-marked except at sides of hind margin. Characteristic features are the rather elongate scape and post-annellus, the closely and rather finely punctate lower part of the mesopleura, the broad or rather broad third valvulae, and the distinctly convergent male eyes. The male is very scarce in collections: Professor Lundblad's bred series, part of which he has presented for the British Museum collection, enabled me to associate the sexes with confidence.

Cteniscus gibbulus Holmgren

Characters diagnosed from a pair taken *in coitu* on a leaf of *Alnus* at Höör, Skåne, Sweden, 25.vi.1938, J. F. Perkins: these were thus determined by him, and also fitted my recollection of the type material.

To those characters given in the key to species I add the following: head less strongly narrowed than in *gnathoxanthus* Grav., sex for sex: mesolcus very strongly impressed: propodeum with keels stronger: petiolar segment with dorsal keels strong, in female almost straight-sided: hind legs rather stouter than in *gnathoxanthus* Grav.: wings with stigma and radial cell not nearly as broad as in *rufonotatus* Hlgr. yet broader than in *gnathoxanthus* Grav., radial cell 2·5 times as long as broad: hind coxae and femora mainly black in both sexes.

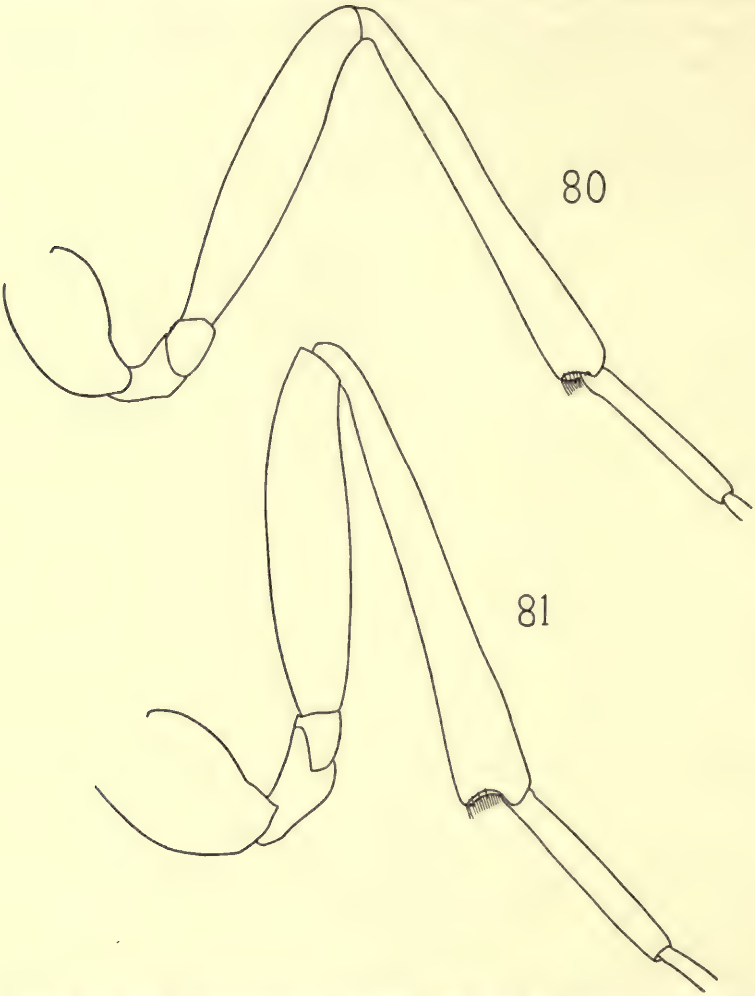
KEY TO PALAEARCTIC BLACK-BODIED SPECIES OF *CTENISCUS* HALIDAY, THOMSON

Black-bodied species, i.e. species with tergites of gaster black or dull castaneous; very often with more or less narrow pale hind margins, which sometimes are triangularly produced forward; in one species often with a rather extensive rufous mark on tergite 2; but *not* with two or more tergites mainly red.

1. Hind tibiae distinctly thickened, as in *hofferi* Greg. (Fig. 81) or more so; in case of doubt scutellum distinctly pale-marked at mid apex 2
   Hind tibiae and tarsi of normal proportions; in case of doubt scutellum not pale-marked at mid apex 5
2. Propodeum normally pilose, shining, and not closely punctate: petiolar segment not strongly raised in middle: hind legs thickened about as in Fig. 81, in inner side view the hind metatarsus about 7½ times length of its greatest breadth 3
   Propodeum strongly griseo-pilose, dull and closely punctate: petiolar segment strongly raised in middle: hind legs more thickened, in inner side view the hind metatarsus about 5½ times length of its greatest breadth . . 4
3. Mesosternum irregularly, rather sparsely and coarsely, almost rugose-punctate: sternaulices very superficial: female third valvulae normally not reaching apex of tergite 8: radial cell usually more than 2·6 times length of its greatest breadth: lower face pale, with only a median dark mark above: female hypopygium pale . . . . *hofferi* Greg.
   Mesosternum regularly, rather finely to moderately and closely punctate: sternaulices moderately impressed: female third valvulae extending a little beyond apex of tergite 8, rather small but stout and densely hairy: radial cell 2·6 times length of its greatest breadth or usually less: lower face with a complete median black band: female hypopygium mainly black, with narrow pale margin . . . . *lineiger* Thoms.
4. Head from above distinctly less than eye length behind eye: upper face moderately punctate: mesopleura rather coarsely and closely punctate below: area superomedia distinctly delimited basally: third valvulae projecting distinctly

beyond apex of tergite 8: scutellum with conspicuous quadrangular yellow mark at mid apex . . . . *curtisii* Hal.

Head from above about equal to eye length behind eye: upper face rather finely and sparsely punctate: mesopleura rather finely and sparsely punctate below:



FIGS. 80–81. Left hind leg, in sinistro-lateral view, of Fig. 80. *Cteniscus gnathoxanthus* Grav. Fig. 81. *Cteniscus hofferi* Greg.

area superomedia not delimited basally: third valvulae broader, projecting scarcely beyond apex of tergite 8: scutellum with no more than a dull red mark at mid apex . . . . *romani* sp. n.

5. Petiolar segment with distinct basal lobes 6

Petiolar segment without distinct basal lobes 7

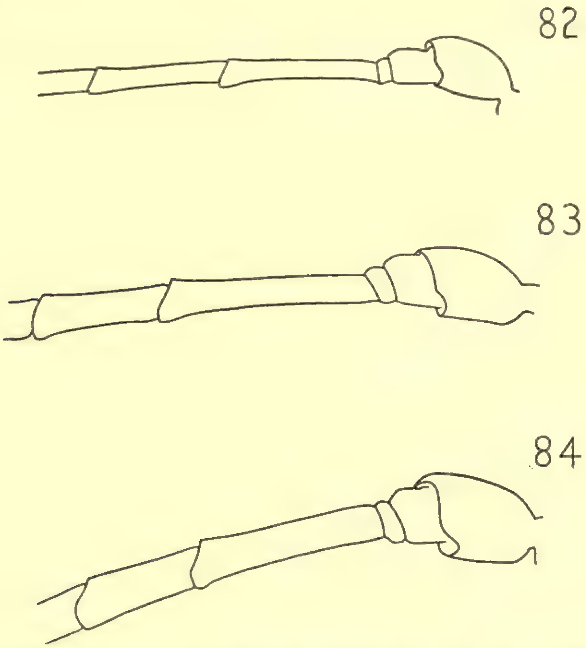
6. Head about as long behind eyes as eye length, seen from above: hypostomal

costa strongly raised: area superomedia about as broad as long: female gaster quite stoutly spindle-shaped: scutellum conspicuously pale-marked at mid apex: female hypopygium pale . . . . *elegans* Steph.

Head much longer behind eyes than eye length, seen from above: hypostomal costa distinctly but not strongly raised: area superomedia distinctly longer than broad: gaster much more elongate: scutellum not pale-marked at mid apex: female hypopygium blackish . . . . . . *similis* Hlgr.

7. Gaster elongate and slender, with tergites 4 and 5 as long as their breadth at base . . . . *pectoralis* Hellén

Gaster of more normal proportions, with tergites 4 and 5 strongly transverse 8



Figs. 82–84. Left antennal scape and following segments of Fig. 82. *Ctenuscus unicinctus* Hlgr. Fig. 83. *Ctenuscus gnathoxanthus* Grav. Fig. 84. *Ctenuscus romani* sp. n.

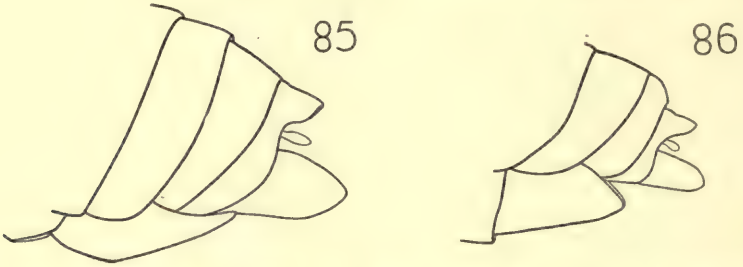
8. Head much longer behind eyes than eye length, seen from above; at least in well-developed specimens distinctly broadened: petiolar segment frequently more elongate than in alternate 9

Head narrowed and not much longer behind eyes than eye length, seen from above: petiolar segment not elongate, not more than about 1½ times length of its greatest breadth in female or 1⅔ times (normally) in male . . 10

9. Antennae with scape strongly convex dorsally and with flagellum decidedly slender (Fig. 82): mandibles with lower tooth more prominent than upper, though a little shorter: female hypopygium sharply folded medially in apical half, pale: male malar space short: lower face without a median dark band: thorax mainly pale below in female . . . . *unicinctus* Hlgr.

Antennae with scape of normal proportions and with antennae not relatively slender: mandibular teeth in same plane: female hypopygium not sharply folded, dark with pale margin: malar space not short in either sex: lower face with a median dark band: thorax scarcely at all pale below . . . . *consobrinus* Hlgr.

10. Head strongly transverse: upper face finely, seldom in part closely punctate: lower mandibular tooth distinctly a little longer and more prominent than upper: female third valvulae narrow (Fig. 86): stigma and radial cell relatively broad, the latter about 2·1 times as long as broad: hind tibiae mainly clear red, darkened only at apex and not stramineous at base: female propleura largely pale . . . . *rufonotatus* Hlgr.
(= *breviventris* Thoms., *fulvipes* Kriechb.)



Figs. 85–86. Apex of gaster, in sinistro-lateral view, of Fig. 85. *Ctenisćus gnathoxanthus* Grav. Fig. 86. *Ctenisćus rufonotatus* Hlgr.

Head not strongly transverse: upper face moderately and more or less closely punctate: lower mandibular tooth not distinctly longer or more prominent than upper: female third valvulae broad (e.g. Fig. 85): stigma and radial cell not nearly so broad: hind tibiae mainly black, distinctly dull stramineous at base: propleura scarcely pale-marked 11

11. Antennae longer and more finely hairy, with postannellus about 1·5 times length of following segment: mesoscutum longer, rather weakly convex: mesopleura closely and rather finely punctate below: propodeum longer, with area superomedia longer than broad: female hypopygium mainly pale, with or with traces of a broad V-shaped dark mark: eyes in male distinctly convergent below . . . . *gnathoxanthus* Grav.

Antennae shorter and more coarsely hairy, with postannellus about 1·3 times length of following segment: mesoscutum shorter, rather strongly convex: mesopleura rather coarsely and not so closely punctate below: propodeum shorter, with area superomedia broader than long: female hypopygium mainly dark, with pale apical margin: eyes almost parallel . *gibbulus* Hlgr.

Ctenisćus aurifluus Haliday

1832 *Tryphon* (subgenus *Ctenisćus*) *aurifluus* Haliday in Curtis, *British Entomology*, **9:** 399.
1838 (Oct.) *Tryphon* (subgenus *Ctenisćus*) *aurifluus* Haliday, *Ann. Mag. nat. Hist.* (1) **2:** 113.
1839 *Exenterus geniculosus* Schiødte, *Guerin's Mag. Zool.* **9:** 11–12 (synonym by Morley 1913).

1858 *Exenterus approximatus* Holmgren, *Svensk Vet.-Akad. Handl.* **1:** 239 (synonym by Roman 1914).
1858 *Exenterus geniculosus* Holmgren, ibid. 241.
1912 *Ctenisc

us geniculosus* Schmiedeknecht, *Opuscula Ichneumonologica,* **5:** 2343–2344.
1913 *Exenterus aurifluus* Morley, *Entomologist,* **46:** 261.
1914 *Ctenisc

us geniculosus* Roman, *Ark. Zool.* **9** (2): 16.

Head little broader than thorax; very slightly broadened behind eyes; broadly and rather shallowly emarginate behind; much longer behind eyes than eye length, seen from above: shining, with vertical region and temples sparsely and very finely punctate; with cheeks, upper face and sides of lower face about twice as densely and more coarsely so, and with epistoma still more densely and coarsely so. Frons with a deep impression above each antennal socket, and with distinct interantennal keel. Clypeus rather coarsely and, in apical half, sparsely punctate; broadly rounded apically; deeply delimited; strongly convex; slightly impressed before apical margin. Malar space about as long as distance between apices of mandibular teeth in female, distinctly shorter in male. Genal costa not continuous, weakly raised apically: hypostomal costa slightly more strongly raised. Upper mandibular tooth a little larger than lower (Fig. 5).

Antennae with scape rather deeply excised externo-ventrally: flagellum 29- to 35-segmented (often with a segment more in one antenna than the other, 34 : 34 in holotype), tapering gradually to apex.

Pronotum with dorsal transverse impression broad and shining; with epomiae of moderate strength; laterally rather finely to moderately punctate above, to some extent longitudinally rugose below. Propleura shining, finely punctate, rugose near inner margin. Mesoscutum dorsally rounded to level of tegulae, thereafter nearly flat to before scutellar fovea; finely punctate, discally somewhat sparsely, peripherally about twice as densely so; between notaulices very weakly rugose: notaulices deeply impressed anteriorly, thereafter very superficial. Scutellum strongly convex and rather sparsely punctate; not margined to middle; its sides irregularly finely to coarsely rugose. Mesopleura and mesosternum moderately punctate, mesopleura sparsely so above; prepectus more coarsely so: epicnemial carina slightly elevated: sternaulices rather strongly impressed: mesolcus broadened posteriorly, completely or partially closed behind. Propodeum finely punctate and shining, more or less rugose behind; with costae strong: basal area distinctly delimited: area superomedia elongate-hexagonal, emitting costulae rather before middle.

Gaster not clavate; with tergites 1, except near mid apex, and 2 and 3 at base very finely leathery in female, rugose in male; elsewhere smooth and shining. Petiolar segment about 1·3 times length of its greatest breadth in female, about 1·5 times in male: very strongly margined; with distinct basal lobes; with spiracles prominent in male; medially strongly raised; with strong keels running from basal excavation for two-thirds to three-quarters the length of the segment and bounding a shallow furrow, deeper in male. Tergite 2 with thyridia rather deep but narrow and inconspicuous; with diagonal basal impressions ill-defined but extensive, in male rather deep and also indicated on tergite 3. Female hypopygium rather narrowly to broadly rounded apically: female third valvulae of moderate breadth.

Fore wings with basal and disco-cubital veins not nearly parallel: with areolet broad and shortly petiolate: with nervus parallelus emitted very low on brachial cell. Hind wings with nervellus antefurcal and intercepted far below middle.

Legs with tarsi relatively short. Tarsal claws not pectinate, or with no more than a trace of pectination.

Length 7 to 10 mm.

Female. Head black, often inclining to blue-black; with large genal and very large lateral facial marks white, these sometimes continuous through malar space: clypeus in apical half, sometimes mainly, white, merging to dull straw-coloured or darker marginally: mandibles in basal half white, merging through dull reddish to black at extreme apices: palpi pale reddish. Antennae basally black, with flagellum ferrugineous (relatively pale in type, which may be faded). Thorax and propodeum black, sometimes with scutellum medially and metascutellum dull red: tegulae straw-coloured, often with an outer darker mark: legs red, with apices of hind femora and tibiae and of all tarsi black. Wings scarcely infumate; with wing-veins and stigma fuscous, basally pale. Gaster with segments 1 to 3 and sometimes base, or the whole, of 4 and even sternite 5 red, tergite 1 being black usually only at extreme base; remainder black: tergites 6 and 7 broadly, and sometimes 3 to 5 narrowly white-margined at apex: ovipositor red.

Male. Differs in absence or great reduction of pale genal marks: clypeus duller: segment 1 of gaster black in about basal half, or sometimes almost to apex: apical segments with narrower pale margins.

This species is illustrated on Pl. 7.

Redescribed from the following material: IRELAND, Co. Sligo, Carrowgarry, 1 ♀, 7.x.1940; Co. Kildare, Kilkea, 1 ♂, 10.ix.1940; Landenstown (marsh), 2 ♀♀, 4 ♂♂, 29.ix. 1946, A. W. Stelfox; Haliday collection, 4 ♀♀, 4 ♂♂, including holotype and allotype (see below), and including 2 ♀♀, 2 ♂♂ with green-marked pinheads indicating definite Irish origin: ENGLAND: Cambs., 1 ♀, L. Jenyns; Wicken Fen, 1 ♀, 3.vi.1934, 1 ♂, 18.viii.1931, G. J. K.; Chesterton, 1 ♀, 16.vii.1934, F. J. Simmonds; Yorks., V.C. 64, Askham Bog, 1 ♂, 15.vii.1944, W. D. Hincks.

Additional material seen: IRELAND, 27 specimens from ten different counties, A. W. Stelfox: BELGIUM, Tronchiennes, 1 ♀, 10.viii.1867, La Hulpe, 1 ♂, 3.viii. 1879, Genval, 1 ♀, 9.vii.1901, J. Tosquinet: SWEDEN, series in Holmgren collection, including unique type of *approximatus* Hlgr. (Stockholm district, 23.viii, C. Boheman): GERMANY, Schwerin, 1 ♂, viii.1889, S. Brauns: RUSSIA, Samara, 1 ♂, vii.1929, Lubischew (coll. A. Seyrig).

Time of appearance: the dates of capture of specimens seen range continuously from 6 July to 12 October. I have wondered whether my own early June date could have been a *lapsus* for July, but Morley (1911) has also recorded the species in early June.

I agree with Roman's placing of *approximatus* Hlgr. in synonymy (1914). The unique male type appears to be a freak form, in which the petiolar segment has the keels and the spiracular tubercles very powerfully developed, and in which the scutellum is very much buckled. The sculpture is mostly developed rather more strongly than usual; and the general form is unusually squat, in conjunction with which the basal and disco-cubital veins are nearly parallel. But in other respects the specimen agrees so closely with the normal form in both structure and colour pattern that I am convinced it is not specifically distinct.

Selection of types. In the Haliday collection are ten specimens which appear to have been attributed to *auriflus*: these may be numbered 1 to 10. No. 1, a male, bears the label 'Named by Claude Morley. Exenterus aurifluus, Hal. ♂♀. vi.1913': this I take to be a general determination label covering the ten specimens. No. 7, a female, bears three labels 'Type C. M.', 'Haliday', and 'aurifluus', the last-mentioned in Haliday's own writing. No. 8, a male, bears the single label 'Haliday'. No. 9, a female, bears the two labels 'Type C. M.' and 'Named by Claude Morley. Ctensicus aurifluus, Hal TYPE vi.1913'. Now Nos. 1 to 8 inclusive belong to the species that has been generally understood as *aurifluus* Hal. (= *geniculosus* Schiødte), and agree with the description given above; but Nos. 9 and 10 are female and male respectively of a different species, which runs down in Schmiedeknecht's key to *pictus* Grav. and fits his description of that form, apart from having an indefinite dark mid line on the yellow lower face.

Why did C. Morley select two types of *aurifluus* and label them as he did? It seemed probable that it was on account of Haliday having quoted both sexes in his diagnosis, and that Morley spared himself the effort of duplicating Haliday's specific label. A. W. Stelfox, who had charge of the collection, wrote to ask whether this were so, pointed out that the second in order had dark hind femora, and asked which of the two should be the first lectotype. In the course of his reply, Mr. Morley wrote that he presumably put a type label on the second *aurifluus* because he had no cotype labels; and that he evidently did not consider the pedal coloration specific. From this it is to be inferred that the first in order, No. 7, is to be taken as Morley's first lectotype.

Distinctions, based on specimens 9 and 10, of *Ct. pictus* Grav. Schmied. from the first species are given below. I think there can be no doubt, on both positive and negative evidence, that Haliday's diagnosis refers to specimens 1–8 and not to 9–10. Accordingly, I designate specimen No. 7, bearing Haliday's own manuscript label, as holotype: thus, the accepted interpretation of Haliday's species is confirmed. Specimen No. 1, a male of definite Irish origin, I designate as allotype.

Cteniscus pictus Gravenhorst, Schmiedeknecht

In the pair misplaced with the series of *aurifluus* in the Haliday collection, I find the following distinctions from that species. Head distinctly broader than thorax, much more transverse. Clypeus narrowly rounded apically, almost truncate in middle of margin. Genae more buccate. Pronotum below more strongly and extensively rugose. Mesopleura distinctly alutaceous: mesolcus narrower and more determinate. Propodeum with costae weaker: area superomedia not basally delimited. Tergite 1 more strongly and regularly narrowed to base. Tergite 3 smooth throughout and tergite 2 almost so. Thyridia conspicuous but not deep. Fore wings with stigma rather broad: with basal and disco-cubital veins nearly parallel. Tarsal claws rather weakly but distinctly pectinate.

Head in both sexes with lower face, except for an indefinite median line, and with clypeus, except around apical and sutural margins, yellow: genae in both sexes with large yellow marks confluent with the yellow of the lower face. Thorax with the following conspicuously flavous: humeral angle of pronotum, hind margin of mesoscutellum at sides, and line below hind wing: also front margin of pronotum above and at sides in male. Legs flavous except as follows: fore and mid coxae at extreme base, and hind coxae and femora mainly, ferrugineous to black: fore and mid coxae mainly, hind coxae apically in male, and all trochanters and trochanterelli, stramineous to flavous. Gaster of female with whole venter red: dorsum mainly red, tergite 1 black except at apex, tergites 6 to 8 mainly and 4 to 5 at sides dark; tergites 5 to 8 apically white-margined: gaster of male more extensively dark.

Summary of the Species treated under *Cteniscus* by Schmiedeknecht (1912)

1.	*gnathoxanthus* Grav.		See above, p. 440.
	ditto	var. 2	? = *elegans* Steph., p. 430.
2.	*fulvipes* Kriechb.		= *rufonotatus* Hlgr., p. 437.
3.	*gibbulus* Hlgr.		see p. 443.
4.	*breviventris* Thoms.		= *rufonotatus* Hlgr., p. 437.
5.	*consobrinus* Hlgr.		see p. 436.
6.	*unicinctus* Hlgr.		see p. 434.
7.	*similis* Hlgr.		see p. 445.
8.	*pullus* Hlgr.		
9.	*morio* Hlgr.		= *Anisoctenion rubiginosus* Grav., p. 328.
10.	*funebris* Hlgr.		see p. 440.
11.	*gracilis* Hlgr.		see p. 440.
12.	*pachysoma* Steph.		
13.	*pratorum* Woldst.		= *Exyston pratorum*, p. 385.
14.	*pictus* Grav.		see p. 449.
15.	*marginatus* Thoms.		
16.	*borealis* Hlgr.		
17.	*alpicola* Hlgr.		placed in synonymy with *borealis* Hlgr. by Roman (1913).
18.	*deletus* Thoms.		
19.	*ustulatus* Hlgr.		placed in synonymy with *flavomaculatus* Grav. by Roman (1931).
20.	*umbellatarum* Woldst.		placed in synonymy with *flavomaculatus* Grav. by Roman (1931).
21.	*rufilabris* Hlgr.		
22.	*flavilabris* Hlgr.		placed in synonymy with *flavomaculatus* Grav. by Roman (1931).
23.	*connatus* Hlgr.		placed in synonymy with *flavomaculatus* Grav. by Roman (1931).

24. *punctipes* Thoms.	
25. *pumilio* Hlgr.	= *Anisoctenion pumilio*, p. 331.
26. *pumilus* Hlgr.	see p. 420.
27. *lineiger* Thoms.	see p. 424.
28. *mitigosus* Grav.	
29. *approximatus* Hlgr.	= *auriflus* Hal., p. 446.
30. *frigidus* Hlgr.	
31. *hostilis* Hlgr.	placed in synonymy with *flavomaculatus* Grav. by Roman (1931).
32. *signifer* Thoms.	
33. *geniculosus* Schiødte	= *auriflus* Hal., p. 446.
34. *sedulus* Woldst.	see p. 315.
35. *punctipleuris* Thoms.	considered to be var. of *dorsator* Thunb. by A. Roman.
36. *limbatus* Hlgr.	= *dorsator* Thunb., see Roman (1912).
37. *brevigena* Thoms.	
38. *flavomaculatus* Grav.	see p. 420.
39. *minutulus* Pfank.	placed in synonymy with *flavomaculatus* Grav. by Roman (1931).
40. *limbatellus* Hlgr.	see p. 420.
41. *genalis* Thoms.	
42. *dahlbomi* Hlgr.	see p. 440.
43. *macrocephalus* Hlgr.	= *unicinctus* Hlgr., p. 434.
44. *autumnalis* Brischke	
45. *rufonotatus* Hlgr.	see p. 437.
46. *quadrinotatus* Thoms.	placed in synonymy with *flavomaculatus* Grav. by Roman (1931).
47. *albicoxa* Thoms.	
48. *T-nigrum* Thoms.	

CONCLUSION

The author is very conscious that much remains to be done; but time could not be spared in the near future for carrying this through, and others await the results so far attained. The genera *Acrotomus* s.str. and *Diaborus* auctt. require intensive revision, and in the latter genus the types should be examined. The red-bodied species of *Cteniscus* merit equal treatment with the black-bodied ones; and it remains to be seen for how many species there are both red and black-bodied forms. The work of Peck (1937) should be followed up and extended, with particular reference to the male genitalia of *Exenterus*. W. R. M. Mason, who is making a study of the New World species, has discovered further fresh characters widely applicable within the tribe; and when these have been fully worked out and published, they should be studied on Old World material. Larvae have been described only in the genus *Exenterus*, so ample scope remains in this tribe for extending the work of Beirne (1941).

SUPPLEMENT

Genus *ACROTOMUS* Holmgren

Compare pp. 319–321 above. I re-examined the material in the C. G. Thomson collection in 1952, and confirmed that Thomson had *succinctus* Grav. under the name *lucidulus*, apart from one specimen to which reference has been made. Under *auriculatus* he had a good series of *lucidulus* Grav. agg.; and these are not of any obviously distinct form, despite his record of their occurrence mostly in conifer woods.

Genus *ANISOCTENION* Förster

Anisoctenion ridibundus Gravenhorst

Compare pp. 336–338 above. Two male specimens, contained in a sending received in 1952 from Professor Sachtleben, bear the following data: GERMANY, Mecklenburg, 6.vi.1894, F. W. Konow. One of these has the broad, percurrent, median black band of the lower face, which has been considered diagnostic for the male of this species; but the other is without it, as in the female.

Anisoctenion genalis Thomson

1883 *Ctenisсus genalis* Thomson, *Opuscula Entomologica*, fasc. 9: 894.

1888 *Ctenisсus* (or *Delotomus*) *genalis* Thomson, *Opuscula Entomologica*, fasc. 12: 1255–1256.

Head, seen from above, about 1¼ times eye length behind eye; slightly narrowed and rounded behind eyes; shallowly emarginate behind: with punctures of mixed sizes, fine to moderate, rather dense on vertical region but much sparser on temples and genae, especially in female: upper face and epistoma densely and rather coarsely punctate, sides of lower face more sparsely and moderately so. Clypeus sparsely beset with coarse and very fine punctures; basally rather deeply but not sharply delimited; moderately or rather strongly convex; broadly rounded at apex in female, moderately so in male. Malar space about equal to distance between mandibular apices. Hypostomal costa rather weakly raised (about as in *ridibundus* Grav.): genal costa weakly but sharply raised, inflected.

Antennae with scape decidedly short and stout, weakly excised externo-ventrally: flagellum 27- to 32-segmented, distinctly expanded in middle in female, with segments distinctly separated in male.

Pronotum with dorsal transverse impression rather weak, transrugose; with epomiae sharp and of moderate strength; laterally closely, moderately to rather coarsely punctate above, coriaceo-rugose below. Propleura rather finely and closely punctate, shining. Mesoscutum rather weakly to moderately convex; with notaulices weak, but sometimes sharply impressed; for the most part moderately and rather closely punctate, or in larger specimens rugulose-punctate, more finely and densely punctate anteriorly between notaulices. Scutellum moderately convex in female, strongly so in male, slightly flattened in larger specimens; margined to beyond scutellar fovea; finely to moderately punctate above and behind; obscurely rugose-punctate at sides in female, more strongly so in male. Mesopleura rather coarsely punctate below, moderately so above: sternaulices moderately impressed: mesosternum rather finely to finely punctate, prepectus moderately rugose-punctate: epicnemial carina slightly elevated: mesolcus not strongly yet very distinctly impressed, broadened and transcostate posteriorly, more or less closed behind. Propodeum finely rugose, with area externa finely to rather finely, and area pleuralis for the most part rather finely to moderately punctate, with costae including costulae normally complete, weak in female but of moderate strength in male: area superomedia not delimited basally, about twice as long as broad, broadest where it emits the costulae, before or behind middle.

Gaster slender spindle-shaped or weakly clavate in female, more parallel-sided behind petiolar segment in male. Petiolar segment 1·4 to 1·5 times length of its greatest breadth in female, 1·4 to 1·6 times in male; laterally sharply margined, strongly so in male; with basal lobes more or less strong and spiracles more or less prominent; with dorsal keels distinct to about middle in female, not much farther in male, and with a shallow median depression behind them; finely to moderately punctate, smoother between keels in female, and smooth at mid apex. Tergite 2 with thyridia broad but inconspicuous. Punctation on tergite 2 rather fine to moderate, on remainder of gaster gradually finer to apex. Female hypopygium quite sharply pointed at apex: third valvulae of moderate size and breadth, with ventral margin almost straight, extending slightly beyond apex of tergite 8.

Fore wings with basal and disco-cubital veins weakly or rather weakly divergent; with areolet usually distinctly petiolate; with nervus parallelus emitted well below middle of brachial cell. Hind wings with nervellus slightly antefurcal, intercepted distinctly below middle.

Legs of normal build. Claws of all tarsi moderately pectinate, the pectination distinctly not reaching apex.

Length 6 to 8½ mm.

Head black, with palpi dull rufous, and with the following parts stramineous to pale flavous, margined with dull fulvous: mandibles except at apex, and clypeus except at base. The dark basal margin of clypeus may be less clearly defined than in *alacer* Grav., and may be darkened only to castaneous. Antennae with flagellum dull rufous in female, more ferrugineous in male; with scape and pedicellus usually concolorous below, but distinctly darker above and at sides; with several basal segments distinctly paler at apex. Thorax and propodeum black, with the following parts in varying degree paler: humeral angles narrowly, marks beside base of scutellar fovea, hind margins of scutellum, and small marks below fore wings: tegulae stramineous. Legs in female with coxae, trochanters, and trochanterelli varying from pale dull rufous, on fore coxae beneath, to more or less infuscate, the trochanters and trochanterelli dull flavous at apex: hind femora rufous, very slightly infuscate at apex: fore and mid femora pale rufous, sometimes flavescent in part: tibiae and tarsi rufotestaceous, with very slight infuscation. Male differs as follows: coxae, trochanters, and trochanterelli much more infuscate, the hind coxae blackish: hind femora varying to ferrugineous: hind tibia and mid and hind tarsi with infuscation stronger. Wing veins and stigma dull testaceous to ferrugineous, paler at base. Gaster with the following parts rufous: tergites 2–4 and female hypopygium and third valvulae, usually also tergite 5, and sternite of petiolar segment and its tergite in about apical third; with tergite 1 in about basal two-thirds or wholly, tergites 5 or 6–8, and last two sternites of male strongly infuscate; often with rather weak, pale hind margins to these sclerites: sternal region otherwise stramineous to pale rufous.

Redescribed from the following material: ENGLAND, Devon, Dartmoor, 1 ♂, 8.vi.1935, R. C. L. Perkins: NORWAY, Buskerud West, Ål, 1 ♀, 8.vii.1898, E. Strand (Deuts. Ent. Inst.): SWEDEN, Skåne, Alnarp, 1 ♀ (type), Pålsjö, 2 ♀♀; Norrland (unlocalized), 1 ♂, C. G. Thomson. The Austrian specimen (see p. 350 above) I determined as *Anisoctenion* sp. near *alacer* Grav. (G. Heinrich 1951, *Bonn. Zool. Beitr.* **2**: 246).

Genus *EUDIABORUS* mihi

Following the statement (pp. 415–417 above) on the state of our knowledge of *Eudiaborus* (= *Diaborus* auctt.), I made a preliminary study of this genus in the early summer of 1952, followed by visits to Lund, Stockholm, and Helsingfors. I believe that the results attained should not be withheld from publication until it is possible to complete a full-scale revision; therefore I intend to communicate them to the Editor of *Opuscula Entomologica*, Lund, and hope that he may be able to publish them in 1953.

Eudiaborus boreoalpinus mihi

This species was described (pp. 417–420 above) on account of the distinctive structure, at least in the female, and on account of the boreo-alpine distribution. Further material has been seen in 1952, and I have been asked to publish the additional records.

Further material seen: GERMANY, Silesia, Glatzer Schneeberg, 1 ♂, 2.viii, 1 ♂, 11.viii, 2 ♀♀, 8.viii.1921, K. Hedwig (Deuts. Ent. Inst.): NORWAY, Buskerud East, Krødsherad, 1 ♀, E. Strand (Deuts. Ent. Inst.): SWEDEN, Lapland, Karesuando, 1 ♀, J. W. Zetterstedt (= *lituratorius* var. b, Zetterstedt 1840, p. 389); Torneträsk, 2 ♀♀, 28.vii, 1 ♀ 9.viii, R. Malaise: FINLAND, Pelkosenniemi, 1 ♀, Clayhills; Kuusamo, 1 ♀, 19.vii. 1934 (ref. 360), R. Krogerus; Kuolajärvi, 2 ♀♀ 27.vii.1934 (ref. 145/6), R. Krogerus.

In smaller female specimens the head may be, as in the males, rather more narrowed and rounded behind the eyes than in the type specimen figured above (Fig. 77). The female propleura may have the outer margin quite broadly black in anterior half. In one Silesian male, the median black band of the lower face is so broadened as to leave only a pair of triangular pale marks going about two-thirds the way up orbits of lower face from the tentorial pits.

In this species the mesosternum of the female is very little concave, whereas in *pallitarsis* Thoms. it is strongly concave.

REFERENCES

BEIRNE, B. P. 1941. A consideration of the cephalic structures and spiracles of the final instar larvae of the Ichneumonidae (Hym.). *Trans. Soc. Br. Ent.* **7** (5): 123–190.

BENSON, R. B. 1950. An introduction to the natural history of British sawflies. *Trans. Soc. Br. Ent.* **10** (2): 45–142.

BRIDGMAN, J. B. 1889. Further additions to the Rev. T. A. Marshall's catalogue of British Ichneumonidae. *Trans. ent. Soc. Lond.* **37**: 409–439.

BRISCHKE, C. G. A. 1871. Die Hymenopteren der Provinz Preussen. (Vierte Fortsetzung.) *Schrift. phys.-ökon. Ges. Königsberg,* **11**: 65–106.

—— 1878. Die Ichneumoniden der Provinzen West- und Ost-Preussen. *Schrift. naturf. Ges. Danzig,* **4**: 35–117.

CARR, L. A. 1924. The Ichneumonidae of the Lichfield district, Staffordshire. *Trans. N. Staffs. Fld. Cl.* **58**: 1–70 (separate pagination).

CLAUSEN, C. P. 1932. The early stages of some Tryphonine Hymenoptera parasitic on sawfly larvae. *Proc. ent. Soc. Wash.* **34**: 49–60.

CURTIS, J. 1832. *British Entomology,* **9**. London.

—— 1837. *A Guide to an Arrangement of British Insects; being a catalogue of all the named species hitherto discovered in Great Britain and Ireland.* Second edition. London.

CUSHMAN, R. A. 1940. A review of the parasitic wasps of the Ichneumonid genus *Exenterus* Hartig. *U.S. Dept. Agric. Misc. Publ.* **354**: 1–14.

—— 1943. Further notes on *Exenterus* (Hymenoptera, Ichneumonidae). *Canad. Ent.* **75**: 167–174.

DALLA TORRE, C. G. 1901–1902. *Catalogus Hymenopterorum,* **3**. Lipsiae.

DAVIS, G. C. 1897. A review of the Ichneumonid subfamily Tryphoninae. *Trans. Amer. ent. Soc.* **24**: 193–348.

DE GAULLE, J. 1908. *Catalogue systématique et biologique des Hyménoptères de France.* Paris, P. Klincksieck.

FORSIUS, R. 1911. Zur Kenntnis einiger aus Blattwespenlarven erzogener Schlupfwespen. *Medd. Soc. Fauna Fl. fenn.* **37**: 98–104.

FÖRSTER, A. 1868. Synopsis der Familien und Gattungen der Ichneumonen. *Verh. naturh. Ver. preuss. Rheinl.* **25**: 135–221.

GRAVENHORST, J. C. L. 1820. Monographia Ichneumonum Pedemontanae Regionis. *Mem. Accad. Sci. Torino,* **24**: 275–388.

—— 1829. *Ichneumonologia Europaea,* **2**. Vratislaviae.

GREGOR, Fr. 1929. Tryphonidi Československé Republiky (Hymenoptera, Ichneumonidae), part 1. *Zprávy čsk. Stát. Reál. Gymn. Nové Jičín,* **1929**: 1–11 (separate pagination).

—— 1933. Beitrag zur Ichneumonidenfauna Bulgariens. *Acta Soc. ent. Čsl.* **30**: 161–168.

—— 1937. Neue Ichneumoniden aus der Tschekoslovakei. *Festschrift E. Strand, Riga,* **2**: 413–417.

HAINES, F. H. 1931. A provisional list of the Ichneumonidae of Dorset and Hampshire. *Trans. ent. Soc. S. Eng.* **7** (1): 1–34.

HALIDAY, A. H. 1838. New British insects indicated in Mr. Curtis's Guide. *Ann. Mag. nat. Hist.* (1) **2**: 112–121.

HEDICKE, H., & KERRICH, G. J. 1940. A revision of the family Liopteridae (Hymenopt., Cynipoidea). *Trans. R. ent. Soc. Lond.* **90**: 177–225, 3 pls.

*HEDWIG, K. 1940. Verzeichnis der bisher in Schlesien aufgefundenen Hymenopteren. V. Ichneumonidae. Fortsetzung. *Z. Ent. Breslau,* **18** (4).

HEINRICH, G. 1949*a*. Ichneumoniden des Berchtesgadener Gebietes (Hym.). *Mitt. münchen. ent. Ges.* **35–39**: 1–101.

—— 1949*b*. Neue und interessante Schlupfwespen aus Bayern (Hym.). Ibid. **35–39**: 101–127.

HELLÉN, W. 1937. Für die Fauna Finnlands neue Ichneumoniden (Hym.). IV. Tryphoninae. *Notul. ent., Helsingf.* **17**: 123–130.

—— 1941. Zur Ichneumonidenfauna Finnlands (Hym.). II. Ibid. **20**: 42–53.

* Original not seen: copy received from author.

HELLÉN, W. 1944. Zur Ichneumonidenfauna Finnlands (Hym.). IV. Ibid. **24:** 1–9.

HINCKS, W. D. 1944. Notes on the nomenclature of some British parasitic Hymenoptera. *Proc. R. ent. Soc. Lond. B*, **13:** 30–39.

HOLMGREN, A. E. 1858. Försök till upställning och beskrifning av de i Sverige funna Tryphonider [Monographia Tryphonidum Sueciae]. *Svensk Vet.-Akad. Handl.* **1:** 93–246, 305–394, 2 pls.

JACOBS, J. C., & TOSQUINET, J. 1890. Catalogue des Ichneumonides de la Belgique appartenant au groupe des Tryphonides. *Ann. Soc. ent. Belg.* **34:** 44–135.

JOHNSON, W. F. 1915. Ichneumonoidea from the north of Ireland. *Irish Nat.* **24:** 130–133.

KERRICH, G. J. 1935. Notes on Ichneumonidae (Hym.) new to or rare in Britain; with a brief review of British lists published since 1915. *Trans. Soc. Br. Ent.* **2** (1): 33–46.

—— 1936. Notes on larviposition in *Polyblastus* (Hym. Ichn. Tryphoninae). *Proc. R. ent. Soc. Lond. A*, **11:** 108–110.

—— 1940*a*. Contribution to our knowledge of the hymenopterous fauna of south-east Finland *Notul. ent. Helsingf.* **19:** 99–109.

—— 1940*b*. *See* Hedicke & Kerrich.

—— 1942. Second review of literature concerning British Ichneumonidae (Hym.), with notes on palaearctic species. *Trans. Soc. Br. Ent.* **8** (2): 43–77.

—— 1950. The Gravenhorst Ichneumonidae (Hym.) of 1820. *Ent. mon. Mag.* **86:** 323–324.

KLOET, G. S., & HINCKS, W. D. 1945. *A Check List of British Insects.* Stockport.

MANEVAL, H. 1925. Capture d'Ichneumonides nouveaux pour la faune française et note biologique sur une espèce de la même famille. *Bull. Soc. ent. Fr.* **1925:** 88–89.

MASON, W. R. M. *in* MUESEBECK, C. F. W. *et al.* 1951. Hymenoptera of America north of Mexico —Synoptic Catalog. Ichneumonidae, tribe Cteniscini: 227–231. *U.S. Dept. Agric., Agriculture Monograph* **2:** 1–1420, 1 map.

MICHENER, C. D. 1944. Comparative external morphology, phylogeny, and a classification of the bees (Hymenoptera). *Bull. Amer. Mus. nat. Hist.* **82:** 151–326.

MORRIS, K. R. S. 1937. The prepupal stage in Ichneumonidae, illustrated by the life-history of *Exenterus abruptorius*, Thb. *Bull. ent. Res.* **28:** 525–534.

MORRIS, K. R. S., CAMERON, E., & JEPSON, W. F. 1937. The insect parasites of the spruce sawfly (*Diprion polytomum*, Htg.) in Europe. Ibid. **28:** 341–393.

MORLEY, C. 1903. *The Ichneumons of Great Britain*, **1.** Plymouth.

—— 1911. *The Ichneumons of Great Britain*, **4.** London.

—— 1913. On the Ichneumonidae of the Dublin Museum. *Entomologist*, **46:** 259–263.

—— 1936. The Hymenoptera of Suffolk. Portio secunda. *Trans. Suffolk Nat. Soc.* **3** (2): 132–162.

PECK, O. 1937. The male genitalia in the Hymenoptera (Insecta), especially in the Ichneumonidae. *Canad. J. Res.* **15D:** 221–274.

PFANKUCH, K. 1906–1907. Die Typen der Gravenhorstschen Gattungen *Mesoleptus* und *Tryphon. Z. Hym. Dipt.* **6:** 17–32, 81–96, 217–224, 289–296; **7:** 17–24, 145–155.

—— 1919. Der äussere Körperbau der echten Schlupfwespen (Ichneumonidae). *Abh. naturw. Ver. Bremen*, **24:** 25–74.

—— 1925. Ein Beitrag zur Ichneumoniden-Fauna Nordschleswigs. *Z. wiss. Insekt. Biol.* **20:** 9–13, 57–61, 150–156, 175–182.

PRATT, H. D. 1940. Studies on the Ichneumonidae of New England (Hymenoptera). Part I. The external morphology of *Arotes amoenus* Cresson. *J.N.Y. ent. Soc.* **48** (2): 155–193.

RICHARDS, O. W. 1934. The American species of the genus *Trypoxylon* (Hymenopt., Sphecoidea). *Trans. R. ent. Soc. Lond.* **82:** 173–362, 5 pls.

ROMAN, A. 1909. Ichneumoniden aus dem Sarekgebirge. *Naturw. Unters. Sarekgeb.* **4** (3): 199–374, 4 pls.

—— 1912. Die Ichneumonidentypen C. P. Thunbergs. *Zool. Bidr. Uppsala*, **1:** 229–293.

—— 1913. Neubeschreibungen und Synonyme zur nördlichen Ichneumonidenfauna Schwedens. *Ent. Tidskr.* **34:** 112–132.

—— 1914. Beiträge zur schwedischen Ichneumonidenfauna. *Ark. Zool.* **9** (2): 1–40.

—— 1917. Skånska parasitsteklar. *Ent. Tidskr.* **38:** 260–284.

ROMAN, A., 1931*a*. Entomologische Ergebnisse der schwedischen Kamtchatka-Expedition 1920–1922. *Ark. Zool.* **23A**(6): 1–32.

—— 1931*b*. Insektfaunan inom Abisko Nationalpark. 4. Parasitsteklar—Ichneumonidae. *Skr. svensk. Vetensk. Akad.* **17:** 3–54.

—— 1932. The Linnean types of Ichneumon flies. *Ent. Tidskr.* **53:** 1–16.

—— 1939. Nordische Ichneumoniden—und einige andere. Ibid. **60:** 176–205.

—— 1942. List of new finds of Ichneumonidae in Norway. *Tromsø Mus. Aarsh.* **60** (3): 1–20.

SCHEIDTER, F. 1934. Forstentomologische Beiträge. 31. Eiablage eines *Lophyrus*-Parasiten, des *Exenterus marginatorius*. *Z. Pfl. Krankh.* **44:** 500–502.

SCHMIEDEKNECHT, O. 1911–12. *Opuscula Ichneumonologica*, fasc. 29–30. Blankenburg-i-Thüringen.

SNELLEN VAN VOLLENHOVEN, S. C., 1872. Nieuwe naamlijst van Nederlandsche vliesvleugelige insecten (Hymenoptera), tweede stuk. *Tijds. Ent.* **16:** 147–220.

SNODGRASS, R. E. 1935. *Principles of Insect Morphology*. New York.

STEPHENS, J. F. 1835. *Illustrations of British Entomology. Mandibulata*, **7.** London.

TEUNISSEN, H. G. M. 1948. Naamlijst van Inlandse Sluipwespen (Fam. Ichneumonidae 1). *Tijds. Ent.* **89:** 10–38.

THOMSON, C. G. 1873. *Opuscula Entomologica*, fasc. 5. Lund.

—— 1883. *Opuscula Entomologica*, fasc. 9. Lund.

TOSQUINET, J. 1890. *See* Jacobs & Tosquinet.

TOWNES, H. K., & TOWNES, M. C. 1949. A revision of the genera and of the American species of Tryphonini (Hymenoptera, Ichneumonidae). *Ann. ent. Soc. Amer.* **42:** 321–447.

VIERECK, H. L. 1912. Tryphoninae—a review. *Proc. ent. Soc. Wash.* **14:** 175–178.

—— 1914. Type species of the genera of Ichneumon Flies. *Bull. U.S. nat. Mus.* **83:** 1–186.

WALLEY, G. S. 1937. The genus *Smicroplectrus* in Canada (Hymen.: Ichneumonidae). *Canad. Ent.* **69:** 131–136.

WESTWOOD, J. O. 1838–40. *An Introduction to the Modern Classification of Insects; founded on the natural habits and corresponding organisation of the different families*. London.

WOLDSTEDT, F. W. 1877. Beitrag zur Kenntniss der um St. Petersburg vorkommenden Ichneumoniden. *Bull. Acad. Sci. St. Pétersbourg*, **23:** 432–460.

ZETTERSTEDT, J. W. 1840. *Insecta Lapponica*. Lipsiae.

APPENDIX I

Table of the Occurrence of Species in certain European Countries

+ signifies specimen(s) seen by author.	○ signifies record requiring confirmation.
× signifies record accepted by author.	— signifies record rejected.

	Ireland	*England*	*Belgium*	*Holland*	*Sweden*	*Finland*	*France*	*Switzerland*	*Germany*	*Czechoslovakia*
Acrotomus lucidulus Grav. agg.		+	+	×	+	+	+	+	+	×
Acrotomus succinctus Grav.	+	+	+	×	+	+	+	+	+	×
Anisoct. triangulatorius Grav.	+	+	+	+	+		+		+	+
Anisoct. rubiginosus Grav.		+	+	+	+	+	+	+	+	+
Anisoct. pumilio Hlgr.		+			+	+	+		+	+
Anisoct. ridibundus Grav.		+	+	×			+	+	+	+
Anisoct. laticeps Grav.		+	+	×	+		+		+	+
Anisoct. laetus Grav.	+	+	+	+	+	+	+	+	+	×
Anisoct. alacer Grav.		+	+	×	+	—	+		+	×
Exenterus apiarius Grav.		+	+	+	+	×	+		+	+
Exent. abruptorius Thunb.		+	○		+	+	+		+	×
Exent. simplex Thoms.					+					
Exent. oriolus Hart.				+	+	+	×		+	+
Exent. ictericus Grav.			+		+	+	+	+	+	×
Exent. amictorius Panz.		+	+	×	+	+	+	+	+	+
Exent. claripennis Thoms.					+	+				
Exent. adspersus Hart.		+	+		+	+	+	+	+	
Exent. tricolor Roman				×	+	+			+	+
Exent. vellicatus Cushm.									+	+
Exent. confusus sp.n.					+	+			+	+
Exyston cinctulus Grav.	+	+	+	+	+	+	+	+	+	+
Exy. genalis Thoms.			+	+	+	+	+	+	+	+
Exy. phaeorrhaeus Hal.	+	+		+			+	+	+	+
Exy. subnitidus Grav.		—						+	×	
Exy. albicinctus Grav.			+	+		+	+	+	+	
Exy. pratorum Woldst.	+	+	+	×	+	+	+	+	+	+
Parexy. calcaratus Thoms.	+	+		+	+	+				×
Smicro. quinquecinctus Grav.	—	+	+	+	+	+	+	+	+	+
Smicro. excisus sp.n.			+	+	+		+	+	+	+
Smicro. trianguligena sp.n.	○	+	+	+			+	+	+	+
Smicro. bohemani Hlgr.		+	+	+	+	+	○	+	+	+
Smicro. perkinsorum sp.n.		+	+	+		+	+		+	+
Smicro. heinrichi sp.n.	+		+	+	+	+		+	+	
Smicro. jucundus Hlgr.		+	—	—	+	+	○	+	+	
Eudiab. boreoalpinus sp.n.					+	+		+	+	
Cteniscus hofferi Greg.	+	+	+	+	+	+			+	+
Ct. curtisii Hal.	+	+	+	+	+	+	+		+	+
Ct. romani sp.n.	+		+	+	+	+	+		+	
Ct. elegans Steph.		+		×	+				+	+
Ct. similis Hlgr.			+	×	+	+	○		+	×
Ct. unicinctus Hlgr.		+	+	×	+		+		+	
Ct. consobrinus Hlgr.	+				+	+				
Ct. rufonotatus Hlgr.	+		+	+	+	+	○	+		
Ct. gibbulus Hlgr.				×	+		○		×	×
Ct. gnathoxanthus Grav.	+	+	+	×	+	+	○		+	+
Ct. aurifluus Hal.	+	+	+		+	×	○		+	

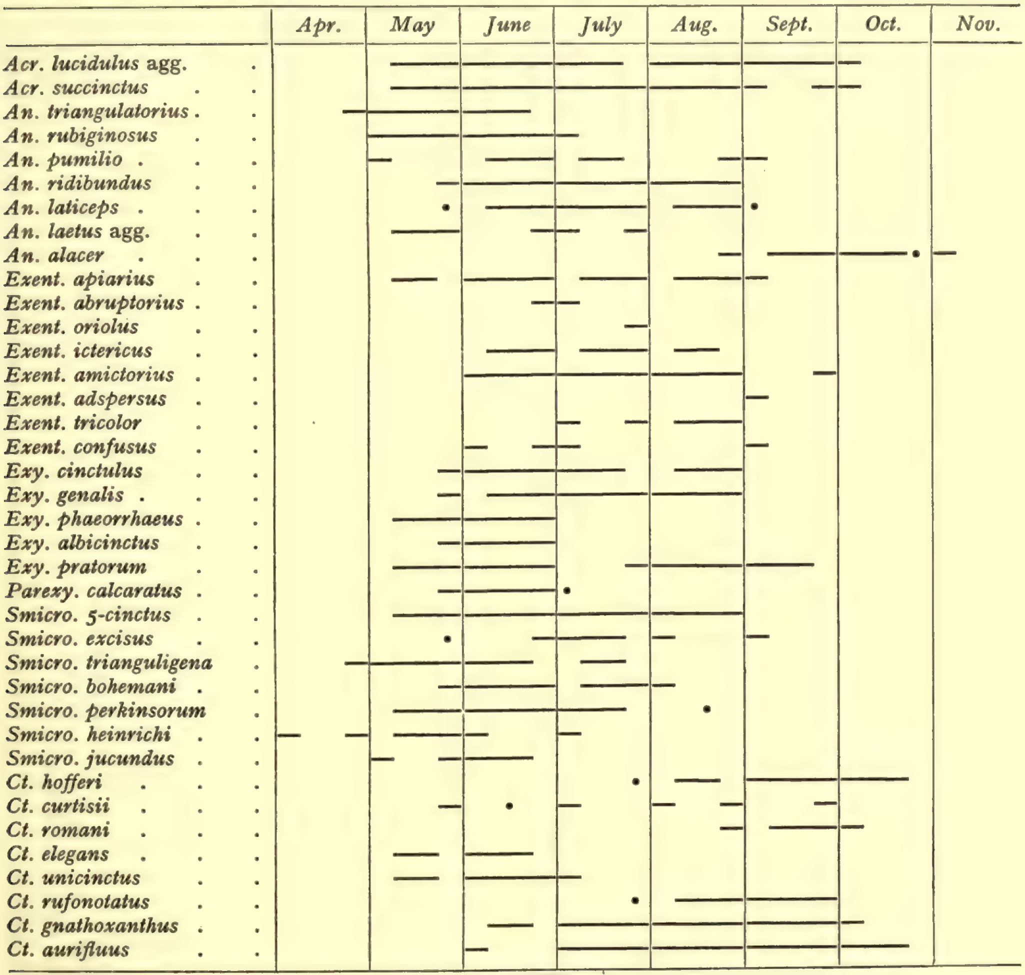
A more detailed analysis of the British fauna will be communicated to the Society for British Entomology. A few additions from other countries were made in paged proof.

APPENDIX II

Flight Table of European Species

This table is compiled from records known or accepted, and is set out in thirds of a month. I have ignored all breeding records, on account of the influence of laboratory conditions; and high Alpine and far northern records, north of 63°, on account of the influence of the shorter summer season.

Dots indicate that the day of the month was not given. It will be appreciated that many of the gaps in the table represent gaps in our knowledge. Some species are omitted, for which there are very few dated records. Some species of *Exenterus* have been more often bred than caught, and dates of capture are correspondingly few.



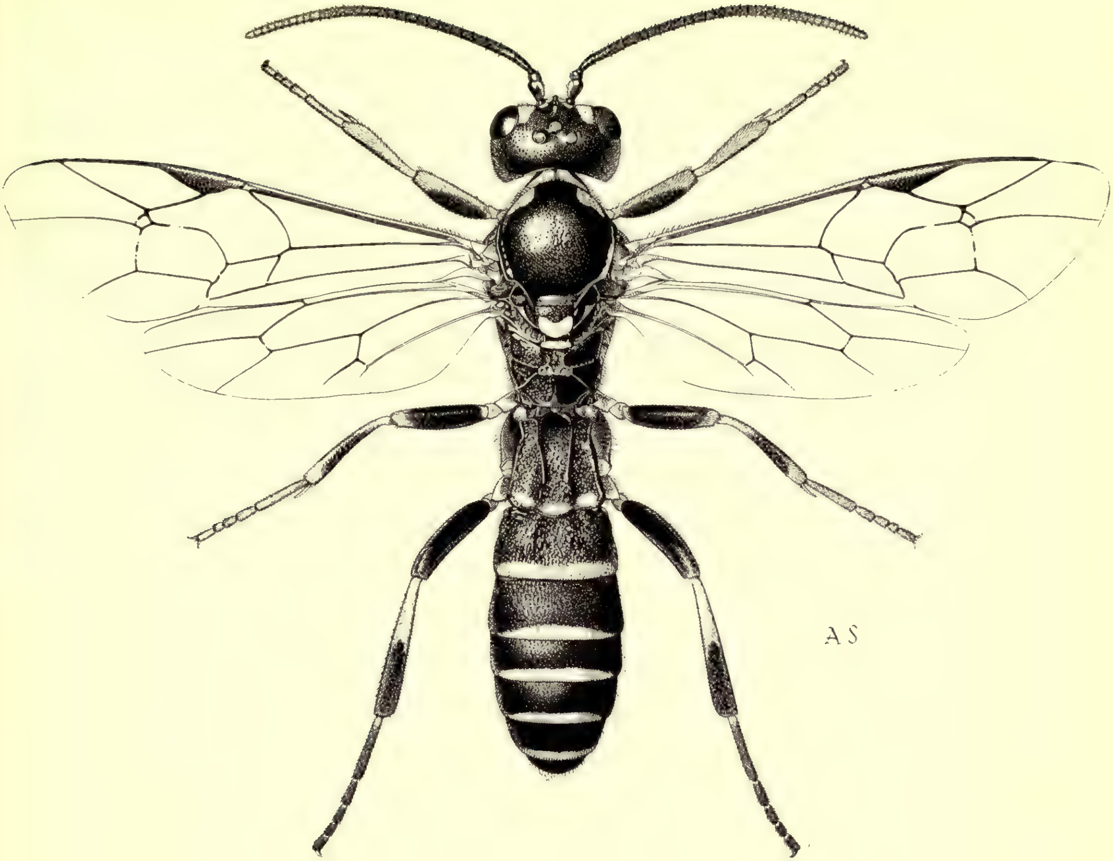
BRITISH MUSEUM NATURAL HISTORY
PRESENTED
22 DEC 1952

PLATE 4. *Exenterus abruptorius* Thunberg.

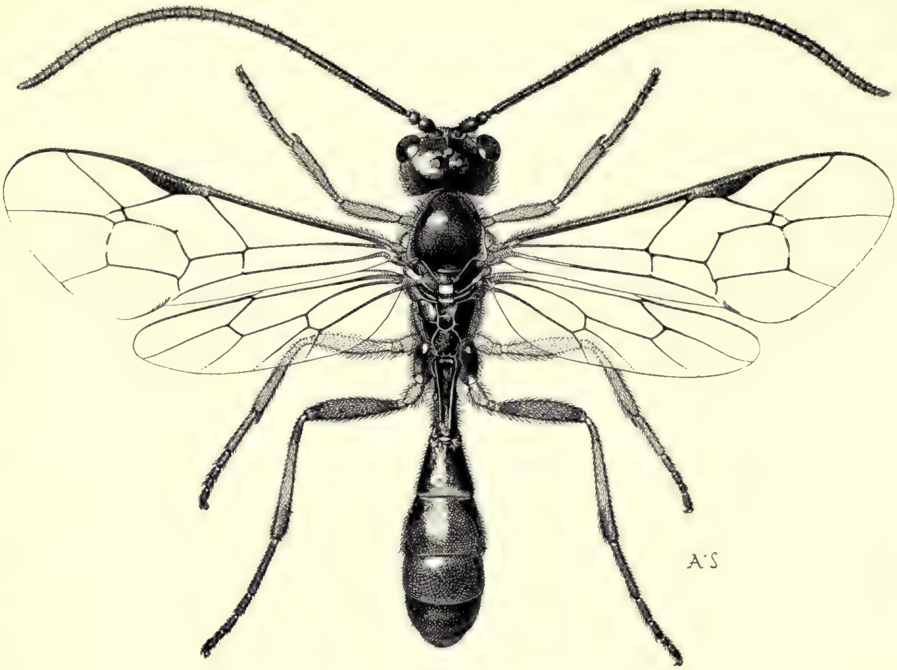
PLATE 5. *Exyston genalis* Thomson.

PLATE 6. *Smicroplectrus quinquecinctus* Gravenhorst.

PLATE 7. *Ctenisçus aurifluus* Haliday.

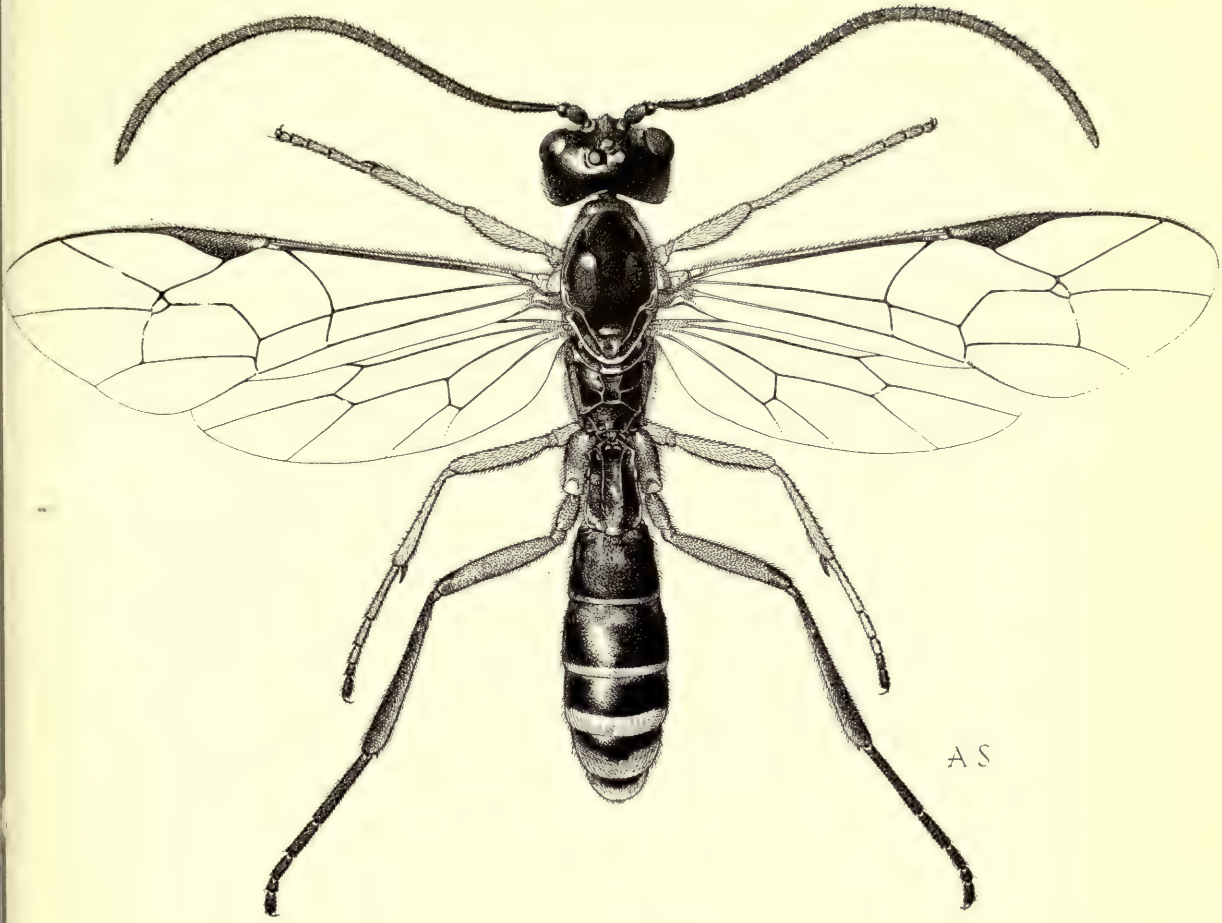


EXENTERUS ABRUPTORIUS THUNBERG

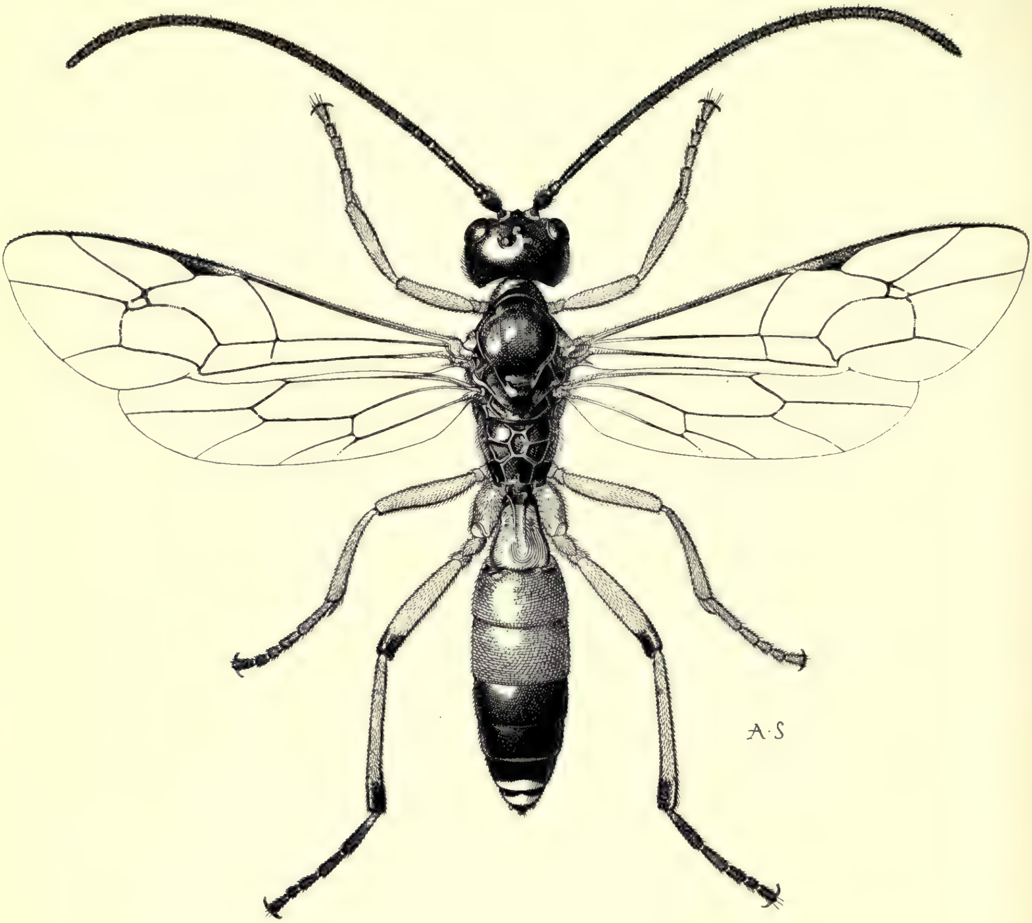


BRITISH MUSEUM NATURAL

EXYSTON GENALIS THOMSON



SMICROPLECTRUS QUINQUECINCTUS GRAVENHORST



CTENISCUS AURIFLUUS HALIDAY

BRITISH MUSEUM NATURAL HISTORY
PRESENTED
22 DEC 1952

INDEX TO VOLUME II

New taxonomic names are printed in bold type

abruptorius, Exenterus . 356, 364, 365, pl. 4
abyssinica, Motes 160
abyssinicus, Philanthus 100
accraensis, Pseudagenia . 169 (figs.), 171–172
Acrotomus . . 311, 313, 314, 316–321, 452
acutangulum, Trypoxylon 99
adspersus, Exenterus . 360–361, 365 (fig.), 366, 367
Aëdes 235–304
Aedimorphus 238
aegypti, Aëdes . . 236–294 (*passim*)
aethiopicus, Tachysphex 157
aethiops, Hemipepsis 167
africanus, Aëdes . . 239–294 (*passim*)
agrestis, Bembix 138
alacer, Anisoctenion 318 (fig.), 327 (fig.), 334, 348–350, 354
albicinctus, Exyston . 382–384, 391, 392
albopictus, Aëdes . . 238, 245, 247, 270
albosignata, Pseudagenia . . 172–174
alcyone, Cerceris . . . . . 115, pl. 5
allonymum, Pison 97
Alysson . . . . . 120–122, pl. 5
amaltheus, Aëdes . . 238, 246, 247, 248
amictorius, Exenterus 358–359, 364, 365 (fig.), 366
Ammatomus 125
Ammophila 141–143
amoenus, Stizus 132
Ampulex 139
Ampulicinae 139
anchietae, Hemipepsis 167
angustus, Aëdes . . . 241, 246, 247
Anisoctenion . 311, 313, 317, 321–354, 452–454
Anopheles 270
Anoplius 180–181
antennatus, Cyphononyx 167
apiarius, Exenterus . 356, 364, 365 (fig.)
apicoargenteus, Aëdes . 238–294 (*passim*)
argyrocephala, Ammophila . 140 (fig.), 143
Armigeres 238
Astata 119
Astatinae 119
aurantiacus, Brachystegus . . 124–125
aurifluus, Cteniscus 317 (fig.), 446–449, pl. 7
avius, Dasyproctus 165

bambusae, Aëdes . . . 241, 246, 249
barbarorum, Ammophila 140 (fig.), 141–142
basalis, Stizus 131
basifasciatus, Dasyproctus . 162 (fig.), 164
basilica, Tachytes . . . 144 (fig.), 146
Batazonellus 178
Bembicinae 132–138
Bembix 133–138
beniniensis, Ammophila 141
bensoni, Stizus . . 129 (fig.), 131–132
bidens, Odontosphex . 151 (fig.), 154–155
bohemani, Smicroplectrus . 401–403, 415
boreoalpinus, Eudiaborus . 417–420, 454
Brachystegus . . . 123–125, pl. 5
brachystylus, Sceliphron 139
braunsii, Stizus . . . 126, 127 (fig.)
brevipalpis, Megarhinus 270
bruneiceps, Tachysphex 155

calcaratus, Anisoctenion . . . 347, 354
calcaratus, Parexyston . . . 392–393
calceatus, Aëdes . . 239, 240, 246, 249
campsomeroides, Cerceris . 109–110, pl. 4
capensis, Ammophila 141
capensis, Batazonellus 178
caprella, Ammophila . 140 (fig.), 142–143
celaeno, Cerceris . . . . 118, pl. 5
cephalotes, Anisoctenion 344–346, 347, 353
Cercerinae 100–119
Cerceris . . . 100–119, pls. 4, 5
Ceropalinae 183
chaussieri, Aëdes 245, 258
cinctulus, Exyston 371–375, 389, 390 (figs.), 391 (fig.), 392
cinerascens, Sphex 145
cinnamomeus, Pompilus 181
claripennis, Exenterus 359–360, 365 (fig.), 366
clavatus, Exyston 375
clémenti, Smicroplectrus 404–405, 413 (fig.), 415
coarctatus, Anisoctenion . 323, 325, 327
coarctatus, Philanthus 99
compacta, Tachytes 148–149
confusus, Exenterus 361–364, 365 (fig.), 366, 367
coniferus, Oxybelus . 162 (figs.), 165–166
consimilis, Philanthus 100
consobrinus, Cteniscus . . 436–437, 446
contiguus, Aëdes . . . 247, 249, 258
contractus, Dolichurus 139
contrarius, Pompilus . . . 181–182
corpulentus, Stizus 127
Crabro 163–165

Crabroninae 163–165
cretinus, Aëdes 289 (fig.), 290
croesus, Motes 159
croesus, Palarus 156 (fig.), 160–161
Cryptocheilus 168
Cteniscini 307–459
Cteniscus 311, 312, 314–317, 319, 341, 343, 350, 351, 354, 420–451
Ctenoceratinae 170–171
Culex 271, 275
curtisii, Cteniscus 426–429, 444
curviscutis, Oxybelus 166
Cyemagenia 176
Cyphononyx 167–168

dahlbomi, Cteniscus 440
Dasyproctus 162, 163–165
deboeri, Aëdes 241, 247, 249
decolorata, Cerceris 105
delta, Aëdes 290
demeilloni, Aëdes 240, 241, 243, 247, 248
denderensis, Aëdes 239, 240, 249, 278 (fig.), 281 (fig.), 282
dendrophilus, Aëdes 238–294 (*passim*)
denticulata, Motes 160
Diaborus 311, 314–316, 319
Diceromyia 273
dilaticornis, Tachytes 147
discrepans, Tachytes 151–152
distinctus, Philanthus 100
Dolichurus 139
dorsator, Cteniscus 341
Dunnius 273

egregia, Motes 160
egregius, Tachysphex 155
Elaphrosyron 178
electra, Cerceris 113–114
elegans, Cteniscus 430–432, 445
Eridolius 319
Episyron 177–178
Eudiaborus 315, 319, 415–420, 454
Excavarus 312, 314, 315
excisus, Smicroplectrus 398–400, 412 (fig.), 415
Exenterus 311, 312, 318, 319, 354–367
Exyston 308, 311, 313–316, 318, 367–392

faceta, Cerceris 111–112, pl. 4
falcigera, Tachytes 151 (fig.), 152
fallax, Hemipepsis 167
fantiorum, Bembix 134 (fig.), 135–136
ferox, Parapiagetia 157
ferrugineipes, Ammophila 141
ferrugineus, Stizus 132
Finlaya 240, 291
flavitincta, Motes 160
flavonasuta, Cerceris 105–107, pl. 4
flavotegulata, Pseudagenia 172
Fleas, from British Birds 187–232
fluctuatus, Tachysphex 155
fluviatilis, Gastrosericus 156 (figs.), 157–158
fraseri, Aëdes 239–294 (*passim*)
fraudulentus, Stizus 129–130
fucata, Tachytes 149
fulviventris, Cerceris 107, pl. 4
fulvo-hirtum, Sceliphron 139
funebris, Paracyphononyx 173 (fig.), 177
fuscipennis, Bembix 137 (fig.)
fuscistigma, Astata 119
fuscus, Anoplius 180–181

gambiae, Anopheles 270
genalis, Anisoctenion 350, 354, 452–454
genalis, Exyston 375–378, 389, 390 (fig.), 391 (fig.), 392, pl. 5
gibbulus, Cteniscus 443, 446
glutiniatus, Eudiaborus 417
gnathoxanthus, Cteniscus 317 (fig.), 440–442, 444 (fig.), 445 (fig.), 446
Gorytes 125, pl. 5
gracilicornis, Motes 160
gracillima, Ammophila 141
granti, Aëdes 238, 244, 249, 289 (fig.), 290
Gripopterygidae [Index to names in Kimmins's paper] 93
griseola, Tachytes 144 (fig.), 149–150
guichardi, Alysson 120–122, pl. 5
guichardi, Marimba 169 (figs.), 170–171
guichardi, Tachytes 144 (fig.), 146–147
Guichardia 178–179
guigliae, Bembix 136–138

habilis, Tachytes 144 (fig.), 147
haemorrhoidalis, Sphex 145
haemorrhoidalis, Stizus 126
hamiltoni, Tachytes 147
heinrichi, Smicroplectrus 408–409, 413 (fig.), 414
heischi, Aëdes 241, 246, 247, 248
Hemipepsis 167
histrio, Episyron 177–178
hofferi, Cteniscus 421–424, 443, 444 (fig.)

ictericus, Exenterus 358, 365
impressiceps, Cryptocheilus 168
incomptus, Sphex 145
infantula, Pseudagenia 172
iniqua, Cerceris 110
insidosus, Elaphrosyron 178
insignita, Cerceris 104–105, pl. 4
intermedia, Bembix 138

jucundus, Smicroplectrus 341, 409–414

kaniacensis, Monoblastus 341
keniensis, Aëdes 241, 245, 246, 248
kenyae, Aëdes 247, 249
kivuensis, Aëdes 245

laetus, Anisoctenion 343–347, 352 (fig.)

laevigata, Pseudagenia 172
laevigatus, Sphex 145–146
laevior, Poenulus 163
lamentabilis, Tachytes 144 (fig.), 148
Larrinae 146–163
langata, Aëdes 239, 247, 249, 258
laticeps, Anisoctenion 318 (fig.), 324, 334 (fig.), 336, 340, 341–343, 352 (fig.)
latifasciatus, Ceropales 183
latus, Ammatomus 125
levis, Pilompus 182–183
lindtropi, Aëdes 290
lineiger, Ctenisucs 424–425, 443
Liris 159–160
longicollis, Poecilagenia 173 (fig.), 174–175
longipalpis, Aëdes 291
longiuscula, Cerceris 101–102, pl. 4
lucidulus, Acrotomus 318 (fig.), 319–321
lutarius, Pompilus 181
luteocephalus, Aëdes 241–291 (*passim*)
lutulenta, Cerceris 102

macfiei, Culex 271
macilenta, Guichardia 178–179
maia, Cerceris 114, pl. 5
Mallophaga [List of species in Clay and Hopkins's paper] 35–36
marginatus, Anisoctenion 346–347, 352 (fig.), 353
Marimba 170–171
mascarensis, Aëdes 238, 244, 248
massaica, Bembix 138
masseyi, Aëdes 246
mazimba, Cerceris 112
Megarhinus 270
melanurus, Exyston 388–389
meneliki, Philanthus 100
meridionalis, Hemipepsis 167
merope, Cerceris 115–117, pl. 5
mesoleptoides, Anisoctenion 325
metallicus, Aëdes 245–292 (*passim*)
mionii, Stizus 132
modestus, Priocnemis 168–170
moggionis, Cerceris 102–104, pl. 4
Monoblastus 311, 341
montanum, Pison 97
montivagus, Gorytes 125, pl. 5
morosus, Anoplius 180
Motes 159–160
multiguttatus, Stizus 126–127

neglecta, Tachytes 148
Nemouridae [Index to names in Kimmins's paper] 93
nigriventris, Stizus 129 (fig.), 130–131
nigrohirtus, Sphex 145
nordströmi, Ctenisucs 426
nugax, Cerceris 121, pl. 5
nugax, Motes 159
Nysson 122–123, pl. 5
Nyssoninae 120–125

obesus, Palarus 161–163
observabilis, Tachytes 146
occidentalis, Dasyproctus 162 (figs.), 164
octomaculatus, Anoplius 179 (figs.), 180
Odontosphex 154–155
oedignathus, Dasyproctus 163
optimus, Cyphononyx 168
oriolus, Exenterus 357, 364
oscari, Paranysson 162 (figs.), 163
Oxybelinae 165–166
Oxybelus 165–166

Palarus 160–163
pallidus, Oxybelus 166
Paracyphononyx 177
Paranysson 163
Parexyston 318, 367, 392–393
pectoralis, Ctenisucs 432–434, 445
Pemphredoninae 163
Pepsinae 167–170
perkinsorum, Smicroplectrus 405–408, 412 (fig.), 413 (fig.), 414
phaeorrhaeus, Exyston 378–380, 381 (fig.), 389, 390 (fig.), 391 (fig.), 392
Philanthinae 99–100
Philanthus 99–100
Phytosphex 153, 154
pictus, Ctenisucs 449–450
pictus, Oxybelus 166
Pilompus 182–183
Pison 97
planatum, Sceliphron 139–140
plumbeus, Pomphilus 181
Poecilagenia 174–176
Polyblastus 308
Pompilidae 166–183
Pompilus 181–182
pratorum, Exyston 385–388, 390 (fig.), 391, 392
Priocnemis 168–170
pronotalis, Anisoctenion 323, 338–341, 352–353
propinquus, Oxybelus 166
Pseudagenia 171–174
Pseudageniinae 171–174
pseudoafricanus, Aëdes 242, 243, 245, 252, 270, 276
pseudocyphononyx, Pseudagenia 171
pseudonigeria, Aëdes 243, 245
pumilio, Anisoctenion 317 (fig.), 331–334, 336, 351
punctaticeps, Ammophila 141
punctipleuris, Ctenisucs 341

quadriceps, Smicroplectrus 414
quadricolor, Nysson 122–123, pl. 5
quinquecinctus, Smicroplectrus 395–397, 398 (fig.), 412 (fig.), 413 (fig.), 415, pl. 6

reticulata, Liris 160
reversa, Gastrosericus 157
rhodesiae, Cerceris 108, pl. 4
ridibundus, Anisoctenion 323, 336–338, 340, 352, 452
ritzemae, Stizus 132
robustus, Stizus 128, 129 (fig.)
romani, Cteniscus 429–430, 444, 445 (fig.)
rubidus, Philanthus 100
rubiginosus, Anisoctenion 328–331, 334, 340, 351
rubrozonata, Cyemagenia 176
rufitibialis, Tachytes 144 (fig.), 150
rufonotatus, Cteniscus 351, 437–440, 446
rugifera, Motes 159
rugosa, Poecilagenia 173 (figs.), 175–176
ruwenzori, Aëdes 245

Sceliphron 139–140
Schistonyx 178
schwetzi, Aëdes 239, 246, 249, 278 (fig.), 281
seminuda, Tachytes 153
senegalensis, Brachystegus 123–124, pl. 5
senegalensis, Cryptocheilus 168
senegalensis, Gastrosericus 156 (fig.), 158–159
senegalensis, Sphex 144–145
setigera, Motes 160
severini, Cerceris 107
sibiricus, Smicroplectrus 403–404, 415
similis, Cteniscus 354, 445
simoni, Sphex 145
simplex, Exenterus 356–357
simpsoni, Aëdes 237–294 (*passim*)
Smicroplectrus 308, 311–314, 319, 341, 393–415
soleatus, Aëdes 239, 246, 249
solstitialis, Motes 159
Sphecidae 97–166
Sphecinae 139–146
Sphex 144–146
spinicaudata, Cerceris 113
splendida, Bembix 133–134
Stegomyia 235–304
sterope, Cerceris 117–118, pl. 5
stigmalis, Pseudagenia 172
Stizinae 126–132
Stizus 126–132
strelitziae, Aëdes 245, 248
subargenteus, Aëdes 245, 248, 272
subnitidus, Exyston 380–382, 391, 392
successor, Anoplius 180
succinctus, Acrotomus 317 (fig.), 318 (fig.), 319–321
sudanensis, Stizus 127–128

Tachysphex 155–157
Tachytes 146–153
taygete, Cerceris 119, pl. 5
tenuis, Anisoctenion 334–336, 352
theseus, Tachysphex 156–157
thysanomera, Motes 159
toroensis, Ampulex 139
transvaalensis, Motes 159
triangulatorius, Anisoctenion 317 (fig.), 323–328, 340, 351, 352 (fig.)
trianguligena, Smicroplectrus 400–401, 413 (fig.), 415
tricolor, Exenterus 361, 366, 367
trinidad, Aëdes 240, 269
Trypoxylon 97–99, 310
Trypoxyloninae 97–99
turneri, Phytophex 154

ugandicus, Philanthus 100
umbrosus, Schistonyx 178
unicinctus, Cteniscus 434–436, 445
uniguttatus, Dasyproctus 164
unilineatus, Aëdes 238–291 (*passim*)

variolosus, Ceropales 182 (fig.), 183
vellicatus, Exenterus 361, 365 (fig.), 366, 367
versatilis, Tachytes 147
viduum, Trypoxylon 97–99
vittatus, Aëdes 238–294 (*passim*)

walegae, Cerceris 110–111
woodi, Aëdes 245

xanthopus, Pison 97

yakui, Anisoctenion 321–323, 351, 352 (fig.)
yungvei, Cerceris 112, pl. 5
ypsilon, Bembix 138

zavattarii, Cerceris 107–108
zonatus, Paracyphononyx 177

BRITISH MUSEUM NATURAL HISTORY
PRESENTED
13 OCT 1953

51/- Pratt.

PRINTED IN
GREAT BRITAIN
AT THE
UNIVERSITY PRESS
OXFORD
BY
CHARLES BATEY
PRINTER
TO THE
UNIVERSITY